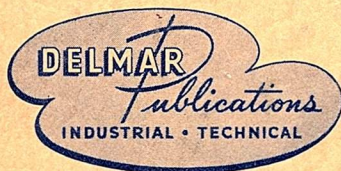


MATHEMATICS

For Carpenters



DELMAR PUBLISHERS, Inc.
Albany, New York

500

Suggested Problems

MATHEMATICS

For Carpenters



DELMAR PUBLISHERS, Inc.
Albany, New York

PREFACE

The skilled mechanic must be able to visualize accurately from drawings and other specifications the shape and size of a single part or larger unit. To take measurements and perform hand and machine operations with precision, it is essential that certain basic mathematical concepts and principles be understood. A working knowledge of mathematics makes it possible to compute required dimensions and take other measurements which are applied on the job and in everyday living.

Over a period of years, the skills that must be developed by craftsmen were studied for a number of apprenticeable trades. The related technical information which must be acquired was also analyzed. From these analyses, selected mathematical principles and concepts were outlined so that suitable trade problems could be organized.

In the development of this material no attempt was made to explain mathematical principles, terms, symbols, or the derivation of formulas. Instead, a sufficient number of trade problems were selected to insure the mastery of each new principle. Each trainee may not be required to complete all problems because of the number of examples of a similar type which have been provided for drill purposes. Assignments to trainees should consider, therefore, the amount of repetitive problem solving required for each individual.

The problems are grouped in "Blocks" and arranged in the natural order of dependence of one topic on the next. As the student progresses within a "Block", the solution of each new problem requires an understanding of more advanced and complex mathematical principles and symbols.

Roman numerals are used to identify each "Block". Where the code letter "S" follows the Roman numeral, as "BLOCK X-S", advanced problems, which in some cases require estimating, are included. The word "Sheet" followed by a number indicates the place in a "Block".

Testing material is provided at the end of each block to make certain that one unit is mastered before advancing to the next. The sizes and dimensions of certain test problems have been omitted to provide variation.

Wherever possible, each step in the solution of a problem should be marked with the proper unit of measurement. The final answer should indicate the unit of measurement followed by the abbreviation (ANS.). Computations should be checked by using a different method, rechecking the steps, or by actual measurement. By following these practices, greater accuracy is assured.

While the problems have been selected, it is possible to change the range and sequence and use supplementary material in order to adapt them to varying local requirements. This flexibility also permits variation in terms of student interest.

* * * * *

Grateful acknowledgement is made to the professional staff of the Bureau of Vocational Education, Connecticut State Department of Education under whose direction this material was prepared. Credit for the organization and development of this problem material is due the trade and related subjects curriculum committees in the Connecticut Vocational - Technical Schools.

The content of this book is identical with the Connecticut State Education Department edition except for those problems which required a special set of drawings that were not readily accessible to all. In such instances, the problems were reworded to do two things: (1) apply in those programs where the specific blueprints can be referred to, and (2) permit other local programs to use whatever blueprints are available for estimating purposes.

Albany, New York
September 1948

RELATED MATHEMATICS SERIES

The RELATED MATHEMATICS SERIES includes nine books which cover eight apprenticeable trades. The instructional material in each text is written in simple trade terminology and well illustrated with line drawings. The mathematical principles covered and the range of problem material provides basic instruction for beginning students and apprentices. These books serve also as reference texts for instructors, craftsmen and other supervisory personnel.

In two of the occupational areas, namely, Machine Trades and Sheet Metal, mathematical terms, symbols and principles are described and problems covering each topic are provided. For the Automobile, Carpentry, Electrical, Masonry, Painting and Plumbing Trades, the instructional units consist of specially selected problem material.

SHEET METAL MATHEMATICS

Mathematical principles and concepts related to sheet metal work were selected from the general fields of arithmetic, algebra, plane geometry and trigonometry and applied in this new text and work book. The mathematical areas covered include: Linear, Angular, Area and Volume Measure; Common and Decimal Fractions; Formulas; Equations; Proportion; Trigonometry and Graphs.

264 pages (7 3/4 x 10 1/4) + XVI pp.; profusely illustrated;
contains problem material; formulas; tables

MACHINE TRADES MATHEMATICS

A practical student text and work book dealing with basic mathematical principles and their application in the Metal Trades in solving everyday shop problems.

172 pages (7 3/4 x 10 1/4); includes 106 pages of problems

MACHINE SHOP MEASUREMENT

A beginner's text and work book which covers basic mathematical principles of linear, circular, and angular measurement from the standpoint of related mathematics and machine shop practice.

65 pages (7 3/4 x 10 1/4); 109 line drawings
(Answer book not available for "Machine Shop Measurement")

* * * * *

The following series, through organization of problem material from the simple to complex, makes it possible for each learner to master the mathematical principles and concepts necessary for a specific trade. Unit tests are included for each "Block" of work.

MATHEMATICS FOR AUTOMOBILE TRADES

97 pages (7 3/4 x 10 1/4) + 7 pp.; IX Blocks; line drawings; tests

MATHEMATICS FOR CARPENTRY TRADES

115 pages (7 3/4 x 10 1/4) + 13 pp.; XIV Blocks; line drawings; 13 tests

MATHEMATICS FOR ELECTRICAL TRADES

88 pages (7 3/4 x 10 1/4) + 8 pp.; XII Blocks; line drawings; 16 tests

MATHEMATICS FOR MASONRY TRADES

74 pages (7 3/4 x 10 1/4) + 6 pp.; XI Blocks; line drawings; 15 tests

MATHEMATICS FOR PAINTING TRADES

67 pages (7 3/4 x 10 1/4) + 13 pp.; VIII Blocks; line drawings; 11 tests

MATHEMATICS FOR PLUMBING TRADES

101 pages (7 3/4 x 10 1/4) + 11 pp.; XI Blocks; line drawings; 15 tests

* * * * *

ANSWER BOOKS ARE AVAILABLE FOR EACH BOOK
IN THE RELATED MATHEMATICS SERIES

MATHEMATICS FOR CARPENTERS

BLOCK I WHOLE NUMBERS

	Block Sequence	Page
A. Addition	1	1
B. Subtraction	2	2
C. Multiplication	3	3
D. Division	4	4
E. Tests . . . . .	.5 to 6	5 to 6

BLOCK II FRACTIONS

A. Writing Fractions	1	7
B. Addition	2	8
C. Subtraction	3	9
D. Multiplication	4	10
E. Division	5	11
F. Tests . . . . .	.6 to 7	12 to 13

BLOCK III DECIMALS

A. Addition	1	14
B. Subtraction	2	15
C. Multiplication	3	16
D. Division	4	17
E. Changing Fractions to Decimals	5	18
F. Changing Decimals to Fractions . . . . .	.6 to 7	19 to 20
G. Changing Fractions to Decimals	8	21
H. Tests . . . . .	.9 to 10	22 to 23

BLOCK IV PERCENTAGE

A. Percentage (Simple)	1	24
B. Interest	2	25
C. Discount	3	26
D. Test	4	27

BLOCK V WEIGHTS AND MEASURES

A. Measures (Linear and Square)	1 . . . . .	.28
B. Measures (Square)	2 . . . . .	.29
C. Measures (Cubic)	3 . . . . .	.30
D. Board Measure . . . . .	.4 to 5 . . . . .	.31 to 32
E. Measures (Miscellaneous)	6 . . . . .	.33
F. Weights	7 . . . . .	.34
G. Tests . . . . .	.8 to 9 . . . . .	.35 to 36

BLOCK VI RATIO

A. Ratio . . . . .	.1 to 2	37 to 38
B. Test	3 . . . . .	.39

BLOCK VII POWERS AND ROOTS

A. Abstract Problems.	1 . . . . .	.40
B. Practical Problems . . . . .	.2 to 3	41 to 42
C. Test	4 . . . . .	.43

BLOCK VIII MENSURATION

A. Area Calculations - Rectangles . . . . .	.1 to 2	44 to 45
B. Area Calculations - Triangles . . . . .	.3 to 5	46 to 48
C. Area Calculations - Irregular Figures . . . . .	.6 to 8	49 to 51
D. Area Calculations - Circles . . . . .	.9 to 10	52 to 53
E. Volume Calculations - Rectangular Solids . . . . .	.11 to 12	54 to 55
F. Volume Calculations - Cylinders . . . . .	.13 to 14	56 to 57
G. Tests. . . . .	.15 to 16	58 to 59

BLOCK IX-S TAKING OFF QUANTITIES

A. Girders	1 . . . . .	.60
B. Sills	2 . . . . .	.61
C. Floor Joists	3 . . . . .	.62
D. Bridging.	4 . . . . .	.63
E. Rough Flooring	5 . . . . .	.64
F. Studding and Draft Stops	6 . . . . .	.65

G. Wall Plates and Shoes	7	66
H. Rafters	8 to 13	67 to 72
I. Sheathing and Roof Boards	14	73
J. Building Paper	15	74
K. Furring and Grounds	16	75

BLOCK X-S OUTSIDE FINISH

A. Wall Covering - Siding	1	76
B. Wall Covering - Shingles	2	77
C. Exterior Trim	3.	78
D. Roof Covering	4	79

BLOCK XI-S INTERIOR TRIM AND FINISH

A. Windows and Window Frames	1 to 2	80 to 81
B. Doors and Door Frames	3	82
C. Stairs and Door Jambs	4	83
D. Interior Trim - Cabinets	5	84
E. Flooring and Paper	6	85

BLOCK XII-S ESTIMATING HARDWARE

A. Rough Hardware	1	86
B. Sheet Metal and Iron Work	2	87
C. Trimming Hardware	3	88

BLOCK XIII-S ESTIMATING LABOR

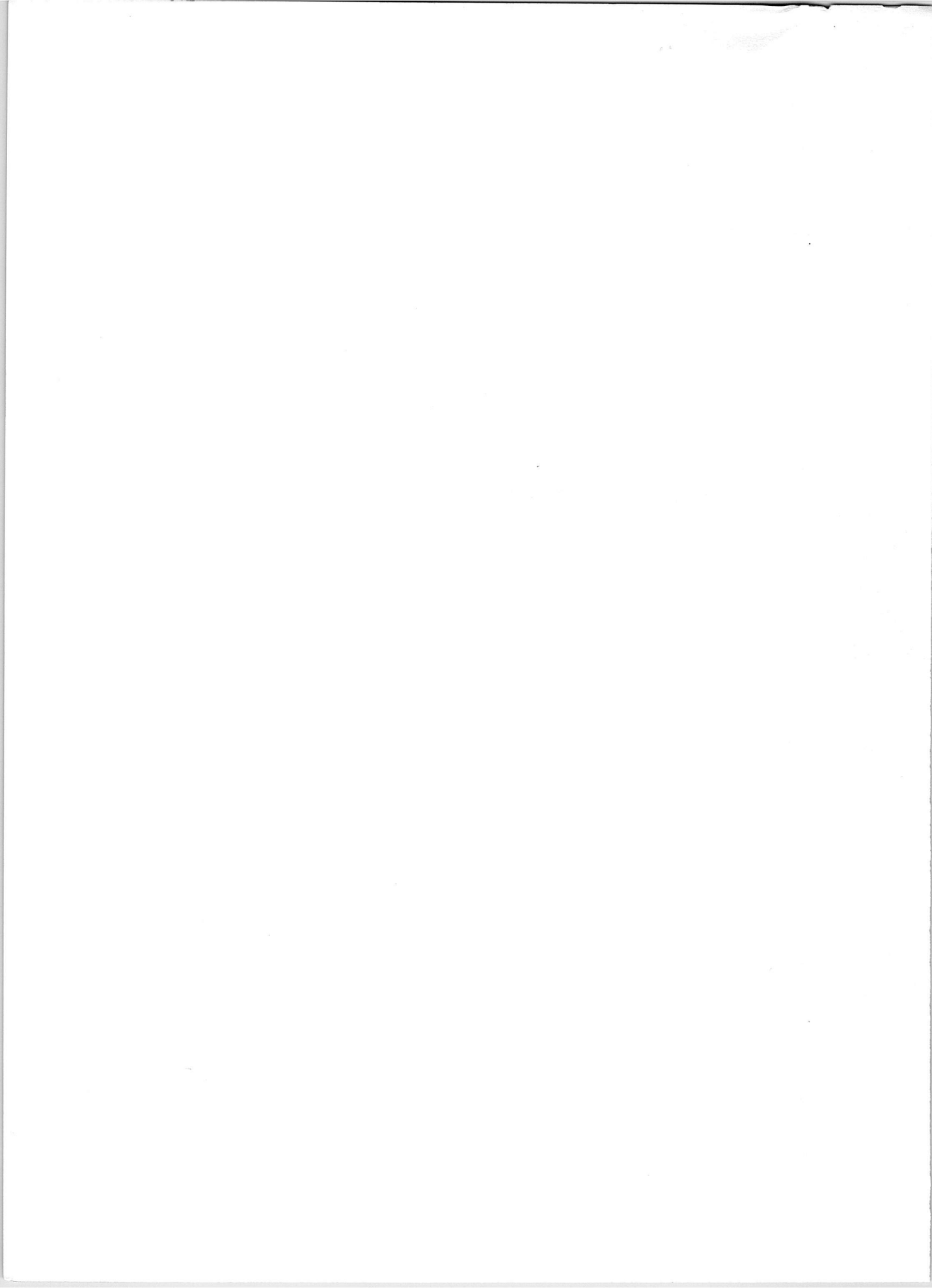
A. Framing, Outside Coverings, Trim	1	89
B. Floor Laying.	2	90
C. Concrete Forms	3	91

BLOCK XIV-S ADVANCED PROBLEMS

A. Concrete Forms	1 to 3	92 to 94
B. Measurements	4	95
C. Miscellaneous	5 to 22	96 to 113
D. Cornices	23 to 24	114 to 115

Suggested Problems

MATHEMATICS FOR CARPENTERS



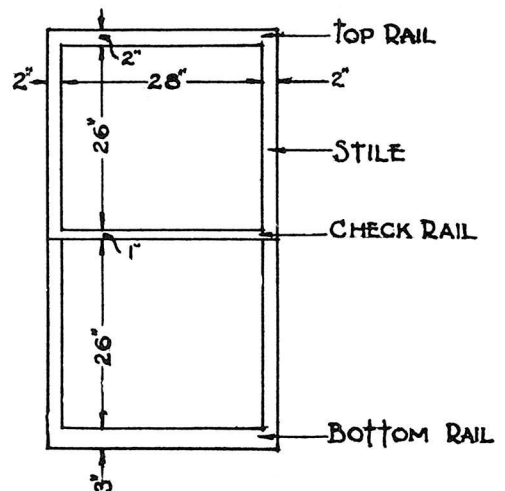
BLOCK I

WHOLE NUMBERS

A. ADDITION OF WHOLE NUMBERS

BLOCK I - SHEET 1

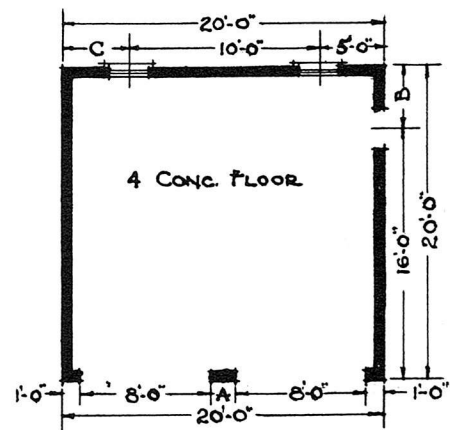
1. A man paid \$600.00 for a lot; \$65.00 for grading; \$132.00 for paving; and \$4,250.00 for his house. What was the total amount expended for these items?
2. Three deliveries of 1" x 6" matched roofers were as follows:- 2,450 bd. ft. (board feet), 2,760 bd. ft. and 2,875 bd. ft. What was the total number of bd. ft. delivered?
3. A carpenter laid 1,300 wood shingles the first day, 1,400 the second and 1,500 the third. How many shingles did he lay in the three days?
4. In a certain house a builder applied 528 sq. ft. (square feet of gypsum wallboard in the kitchen, 640 sq. ft. in the living room, and 580 sq. ft. in the dining room. How many sq. ft. did he apply?
5. A contractor bought 14,500 bd. ft. of 1" native pine, 1,250 bd. ft. of 2" spruce and 1,450 bd. ft. of 3" hemlock. How many bd. ft. of lumber did he buy in all?
6. The material for a barn cost as follows:- lumber \$476.00; masonry \$148.00; hardware \$62.00; and painting \$85.00. What was the total cost of material?
7. A carpenter earned \$38.00 the first week; \$36.00 the second; \$40.00 the third; and \$41.00 the fourth. What was his total earnings for the four weeks?
8. In estimating the finished flooring for a house, a contractor listed the room areas as follows:- living room 168 sq. ft.; dining room 152 sq. ft.; bed room 142 sq. ft.; hall 45 sq. ft.; and kitchen 125 sq. ft. What was the total area to be floored?
9. In building a house the following items of framing timber were ordered:- 472 bd. ft. of 2" x 4" studs; 1,627 bd. ft. of 2" x 10" joists; 827 bd. ft. 2" x 6" stock; 572 bd. ft. of 2" x 8" stock. How many bd. ft. of framing timber were ordered?
10. At the right is shown a double-hung window. What would be the inside dimensions of the frame for this window?
11. Allowing a total of 10" in width and 10" in height over the glass size, what would be the dimensions of the rough frame opening for this window?



DOUBLE HUNG SASH

B. SUBTRACTION OF WHOLE NUMBERS

1. A lumber man had 632,000 bd. ft. (board feet) of native pine. If he sold 328,582 bd. ft., how many bd. ft. remained?
2. A carpenter built a veranda by contract for \$450.00. His material, labor and other costs totaled \$365.00. What was his profit?
3. A contractor bought 6,000 bd. ft. of oak flooring. He used 1,928 bd. ft. on the one house, and 1,850 bd. ft. on another. How much flooring had he left?
4. The wall space on one side of a kitchen was 12'-0" long. Of this space the sink occupied 4'-0" and a window 3'-0". How many inches were left for a cabinet?
5. The balance in a contractor's checking account in a certain bank is \$1,176.00. If he draws on it for a pay roll amounting to \$321.00, what will his balance be?
6. In building forms for a concrete foundation 7,250 sq. ft. of lumber were used, 2,190 sq. ft. (square feet) of which were wasted in pulling down the forms. How much stock was left for further use?
7. A residence was built which cost the owner \$10,000.00. The itemized costs to contractor were; lot \$2,150.00; grading \$474.00; excavating \$525.00; masonry and plastering \$625.00; carpentry work \$3,000.00; plumbing \$278.00; heating \$470.00; electric wiring and fixtures \$553.00; painting and decorating \$293.00; and for minor charges such as permits, deeds etc.; \$321.00. What was the profit made by the contractor?
8. At the right is the floor plan of a two car frame garage. What is the width of the wall space at the front of the garage marked "A"?
9. What is the distance "B" from the outside of the rear wall of the garage to the center of the side door opening?
10. What is the missing dimension at the rear of the garage marked "C"?
11. A builder contracted to build a house for \$4,885.00. The expenses for material and labor were \$4,552.00. How much was his profit?

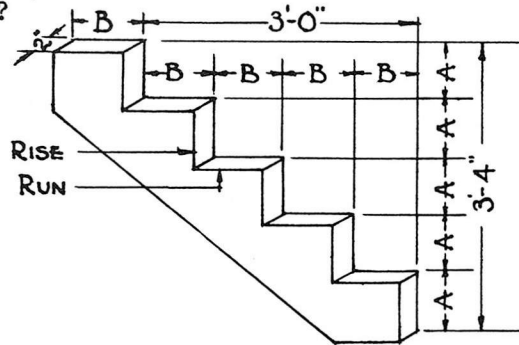


C. MULTIPLICATION OF WHOLE NUMBERS

1. Figure the cost of 18,000 bd. ft. (board feet) of fir at \$42.00 per thousand bd. ft.
2. A contractor bought 7,000 bd. ft. of native pine at \$40.00 per M. Find the total cost of the material.
3. How many wood shingles laid 5 1/2" to the weather, will be required to cover an area of 1,750 sq. ft., (square feet) allowing 7 shingles to each square foot?
4. Find the cost of 28 "squares" of asphalt shingles at \$8.00 per square. (A square is 100 sq. ft.)
5. Allowing 760 shingles per square (100 sq. ft.) when laid 5" to weather, how many will be required to cover 24 squares with the same weathering?
6. Allowing 15 lath per square yard, how many lath will be required for a wall surface of 650 sq. yds.?
7. How many square feet of "sheetrock" are required to cover one side of a partition 24'-0" long by 8'-0" high?
8. If there are 200, 4" x 18" red cedar shingles in one bundle, how many will there be in 196 bundles?
9. If there are 250, 4" x 16" white cedar shingles in one bundle, how many will there be in 258 bundles?
10. In making a table in the carpentry department, 19 bd. ft. of oak were used including waste. How much stock will be used in completing an order for 54 such tables?
11. A breakfast set requires 43 bd. ft. of lumber. How many board feet will be needed for 53 sets that are to be made for a tea room?
12. How much time should a carpenter charge against a job if he works 84 days at an average of 7 hours a day?
13. In an apartment house the floor surface of one apartment is 784 sq. ft. Find the floor area in 13 apartments of the same area.
14. Galvanized nails used for nailing asphalt shingles cost \$10.00 per keg containing 100 pounds. How much would 12 kegs of these nails cost?

D. DIVISION OF WHOLE NUMBERS

1. How many balusters spaced 4" on centers will be required for 16'-0" of veranda rail? There is a newel post at each end.
2. How many joists spaced 16" o. c. (on centers) are required for a floor 52'-0" long? Note: Add 1 for a "starter".
3. Find the number of studs spaced 16" o. c. required for a carrying partition 64'-0" long. Note: Add 1 for a "starter".
4. How many rafters spaced 24" o. c. are required for one side of a common gable roof 34'-0" long? Note: Add 1 for a "starter".
5. How many lally columns spaced 8'-0" o. c. are required for a girder 72'-0" long, both ends of which are being supported on foundation walls?



STAIR STRINGER

6. The above drawing shows a stringer for a short flight of steps. Dimension "A" is the height or rise of each step. Determine distance A.
7. Determine the run (tread land) of each step indicated by "B" in the above drawing.
8. How many rafters spaced 24" o. c. will be required for two sides of a gable roof that is 72'-0" long? Note: Add 1 for each side of the roof as a "starter".
9. The main stairway in a residence is to have 17 risers. If the story height i.e. distance from top of the 1st floor to the top of the 2nd floor, is 9'-11", what will be the height of each step?
10. The form for a concrete wall has an area of 420 sq. ft. (square feet) and is 7'-0" high. How long is the form and how many studs are there if they are 18" on centers? Add one (1) stud for a starter.

E. TEST NO. 1

1. Three deliveries of 1" x 6" matched roofers were as follows:-
 _____ bd. ft. (board feet) _____ bd. ft. and _____ bd. ft.
 What was the total number of bd. ft. delivered?
2. A carpenter laid _____ wood shingles the first day, _____
 the second and _____ the third. How many shingles did he lay
 in the three days?
3. A contractor bought _____ bd. ft. of 1" native pine, _____
 bd. ft. of 2" spruce and _____ bd. ft. of 3" hemlock. How
 many bd. ft. of lumber did he buy in all?
4. A carpenter earned \$ _____ the first week; \$ _____ the second;
 \$ _____ the third; and \$ _____ the fourth. What was his total
 earnings for the four weeks?
5. In building a house the following items of framing timber were
 ordered:- _____ bd. ft. of _____ studs; _____ bd. ft. of _____
 _____ joists; _____ bd. ft. _____ stock; _____ bd. ft. of _____
 stock. How many bd. ft. of framing timber were ordered?
6. A contractor bought _____ bd. ft. of oak flooring. He used
 _____ bd. ft. on the one house, and _____ bd. ft. on an-
 other. How much flooring had he left?
7. The wall space on one side of a kitchen was _____ long. Of
 this space the sink occupied _____ and a window _____. How
 many inches were left for a cabinet?
8. The balance in a contractor's checking account in a certain bank
 is \$ _____. If he draws on it for a pay roll amounting to
 \$ _____, what will his balance be?
9. In building forms for a concrete foundation _____ sq. ft. of
 lumber were used, _____ sq. ft. (square feet) of which were
 wasted in pulling down the forms. How much stock was left for
 further use?
10. A residence was built which cost the owner \$ _____. The item-
 ized costs to contractor were; lot \$ _____; grading \$ _____;
 excavating \$ _____; masonry and plastering \$ _____; carpentry
 work \$ _____; plumbing \$ _____; heating \$ _____; electric wire
 and fixtures \$ _____; painting and decorating \$ _____; and for
 minor charges such as permits, deeds, etc. \$ _____. What was
 the profit made by the contractor?
11. A contractor bought _____ bd. ft. of native pine at \$ _____ per M.
 Find the total cost of the material.
12. How many wood shingles laid _____" to the weather, will be required
 to cover an area of _____ sq. ft., (square feet) allowing _____ shingles
 to each square foot?

E. TEST NO. 2

1. Find the cost of _____ "squares" of asphalt shingles at \$ _____ per square. (A square is 100 sq. ft.)
2. Allowing _____ shingles per square (100 sq. ft.) when laid _____ " to weather, how many will be required to cover _____ squares with the same weathering?
3. Allowing _____ lath per square yard, how many lath will be required for a wall surface of _____ square yards?
4. How many square feet of "sheetrock" are required to cover one side of a partition _____ long by _____ high?
5. In making a table in the carpentry department, _____ bd. ft. of oak were used, including waste. How much stock will be used in completing an order for _____ such tables?
6. In an apartment house the floor surface of one apartment is _____ sq. ft. Find the floor area in _____ apartments of the same area.
7. A breakfast set requires _____ bd. ft. of lumber. How many board feet will be needed for _____ sets that are to be made for a tea room?
8. How many joists spaced _____ " o.c. (on centers) are required for a floor _____ long? Note: Add 1 for a "starter".
9. How many rafters spaced _____ " o.c. are required for one side of a common gable roof _____ long? Note: Add 1 for a "starter"
10. How many rafters spaced _____ " o.c. will be required for two sides of a gable roof that is _____ long? Note: Add 1 for each side of the roof as a "starter".
11. The main stairway in a residence is to have _____ risers. If the story height i.e. distance from top of the 1st floor to the top of the 2nd floor, is _____, what will be the height of each step?
12. The form for a concrete wall has an area of _____ sq. ft. (square feet) and is _____ high. How long is the form and how many studs are there if they are _____ " on centers? Add one (1) stud for a starter.

BLOCK II
FRACTIONS

A. WRITING FRACTIONS

BLOCK II - SHEET 1

FIGURES 1 AND 2 BELOW ARE FULL SIZE REPRESENTATION
OF AN ORDINARY CARPENTERS RULE.

1. Write in figures, the inches and fractional parts of an inch represented by the dimensions lettered from A to I in Figure 1.
2. Write in figures, the inches and fractional parts of an inch represented by the dimensions lettered from J to R in Figure 2.

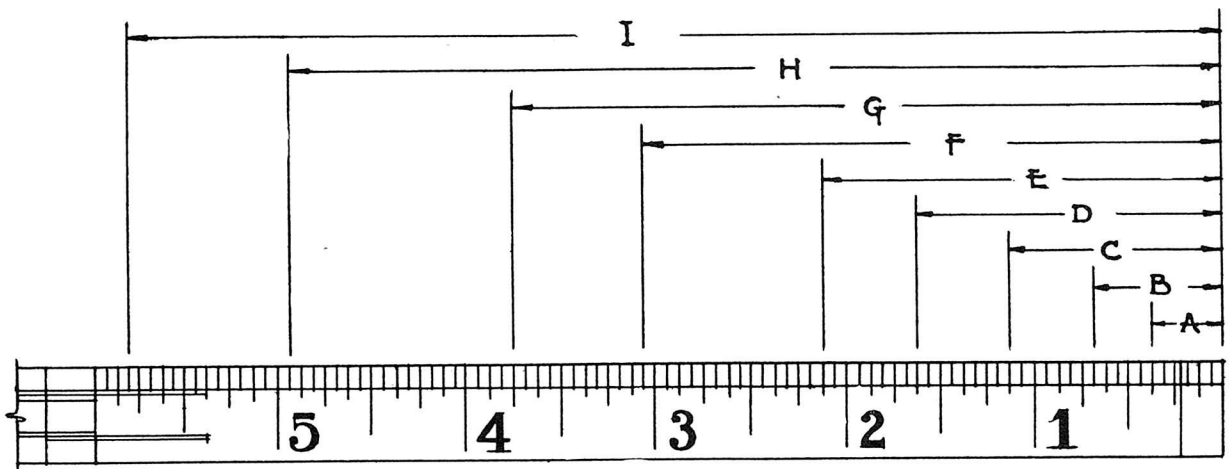


Fig. 1

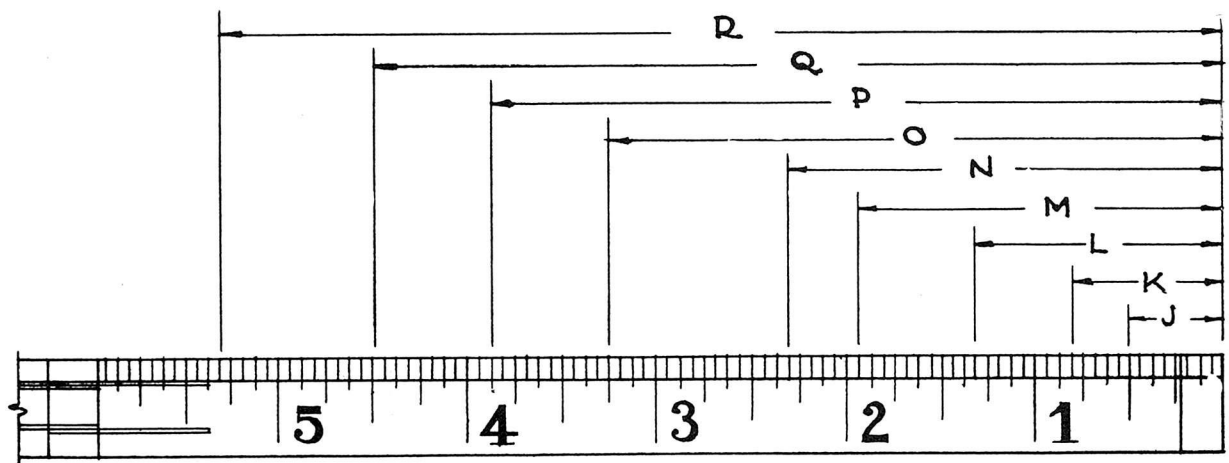


Fig. 2

B. ADDITION OF FRACTIONS

1. A section of the outside wall of a frame building is shown in Fig. 1.

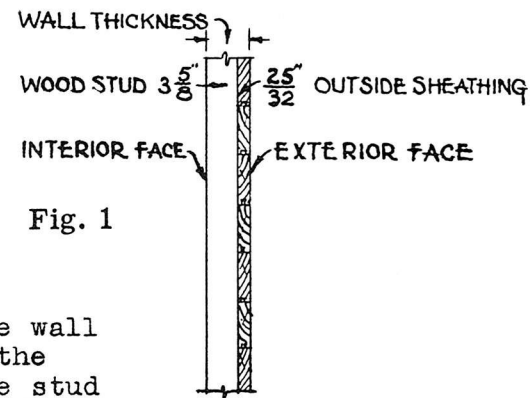


Fig. 1

1. What is the wall thickness?
2. The wood sheathing on the exterior face of the wall in Fig. 1, is to be covered with wood shingles which will add $\frac{5}{8}$ " to the thickness. What will be the thickness of the wall, after it is shingled?
3. What will be the total thickness of the wall in Fig. 1, if after it is shingled on the exterior face, the interior face of the stud is covered with wood lath and plaster $\frac{3}{4}$ " thick?
4. Lath and plaster partitions separate the rooms of a house. If the partition studs are $3 \frac{5}{8}$ " thick and the lath and plaster on each face of the stud is $\frac{3}{4}$ " thick, what is the thickness of the partition?

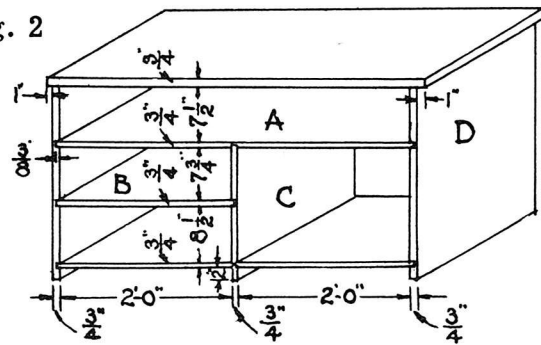
5. Determine the length of the top of the cabinet in Fig. 2.

6. What is the height of the cabinet in Fig. 2?

Fig. 2

7. How long is the shelf marked "A" in Fig. 2?

8. What is the length of the shelf marked "B" in Fig. 2?



9. What is the distance from the outside face of the end of the cabinet marked "D" to the corresponding face of the dividing partition marked "C" in Fig. 2?

10. What is the distance from the top of the shelf marked "A" to the top of the cabinet in Fig. 2?

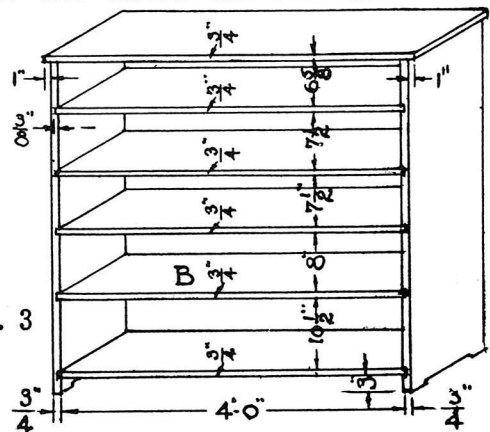
11. What is the overall height of the bookcase shown in Fig. 3, at the right?

12. What is the overall width of the shelves of the bookcase in Fig. 3?

13. Find the length of the top of the bookcase in Fig. 3?

Fig. 3

14. How high is the top of the shelf "B", Fig. 3, from the floor?



15. What are the lengths of the finished pieces used for the ends of the bookcase in Fig. 3?

C. SUBTRACTION OF FRACTIONS

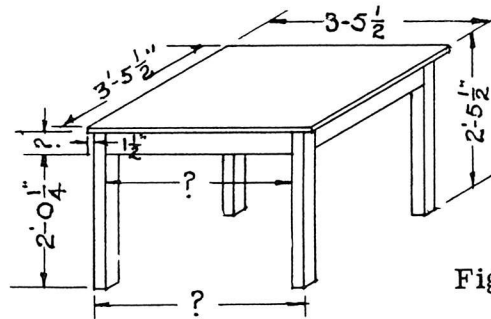


Fig. 1

1. Figure 1, shows an oblique view of a table. If the table top is $\frac{3}{4}$ " thick, how long are the table legs?
2. If the table in Figure 1, has legs which are $2 \frac{1}{4}$ " square, what is the distance between the legs?
3. If the table top, Figure 1, is $\frac{3}{4}$ " thick, what is the width of the rail?
4. In Figure 1, what is the measurement from the outside face of one table leg to the outside face of the other table leg?
5. How long should the rail be cut, if $2 \frac{1}{2}$ " extra is allowed for the tenons?
6. What is the overall length of the shelves in Figure 2?
7. What is the distance between the end pieces of this cabinet?
8. If the shelves in Figure 2, are spaced 11" top to top, what is the distance between two successive shelves?
9. The back of the cabinet, shown in Fig. 2 is $\frac{3}{16}$ " thick. What is the depth of the shelves, if the back sets flush with the back edge of the ends?
10. A carpenter cut a piece of glass $7 \frac{7}{8}$ " long from a piece $15 \frac{1}{4}$ " long. How long was the remaining piece?
11. From a piece of sheet lead $2'-6"$ long, a carpenter cut the following lengths:- $8 \frac{7}{8}$ "; $5 \frac{1}{4}$ "; $4 \frac{3}{4}$ ". What was the length of the piece of lead left?
12. A carpenter built a work bench $2'-6"$ high. If the bench top was $1 \frac{5}{8}$ " thick, what was the height of the bench legs?
13. From a 16' board, a carpenter cut the following lengths:- $3'-9 \frac{5}{8}$ "; $3'-4 \frac{1}{4}$ "; $1'-7 \frac{1}{2}$ "; and $2'-3 \frac{3}{4}$ ". Allowing $\frac{1}{16}$ " per cut, how much of the board was left?

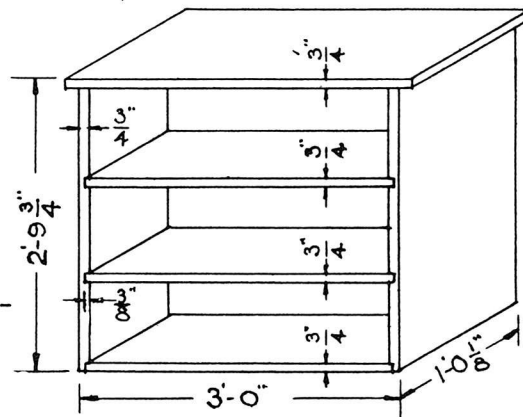


Fig. 2

D. MULTIPLICATION OF FRACTIONS

1. If $\frac{1}{4}"$ on a drawing represents $1'-0"$, how many inches on the drawing will be required to represent $18'-0"$?
2. In building a tray, four pieces of wood $11 \frac{3}{8}"$ long are required. If we allow $1"$ for waste in cutting the pieces, how long must a board be to get out all four pieces?
3. A board is to be ripped into four strips. Each one must be $2 \frac{3}{4}"$ wide. Allowing $\frac{7}{8}"$ for waste in milling the stock, what width board should be used?
4. A flight of stairs (see Fig. 1) has 9 risers. The height of each riser is $7 \frac{5}{8}"$. What is the height (total rise) from finished floor to finished floor?
5. If the run of each step on the flight of stairs shown in Fig. 1, is $9 \frac{3}{8}"$, what is the total run of the flight?
6. What would be the height of a flight of stairs having 14 risers $7 \frac{3}{4}"$ high?
7. There are 13 treads, each having a run of $9 \frac{1}{4}"$, in a flight of stairs. What is the total run of the stairs?
8. What length of $2" \times 4"$ material will be required to make 6 bench legs $2'-4 \frac{1}{4}"$ long?
9. The drawing below is a portion of the rear elevation of a frame dwelling. The clapboards shown are spaced $4 \frac{3}{4}"$ to the weather. By counting the clapboards calculate the dimensions A, B, C, D, and E.

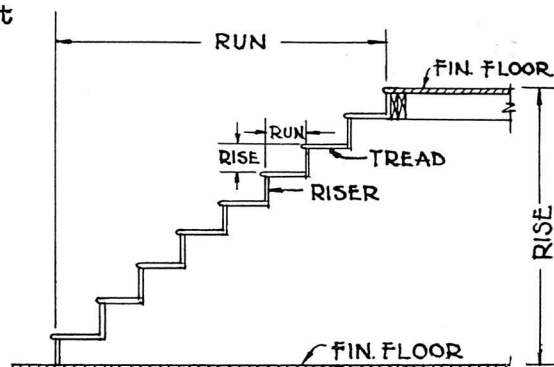


Fig. 1

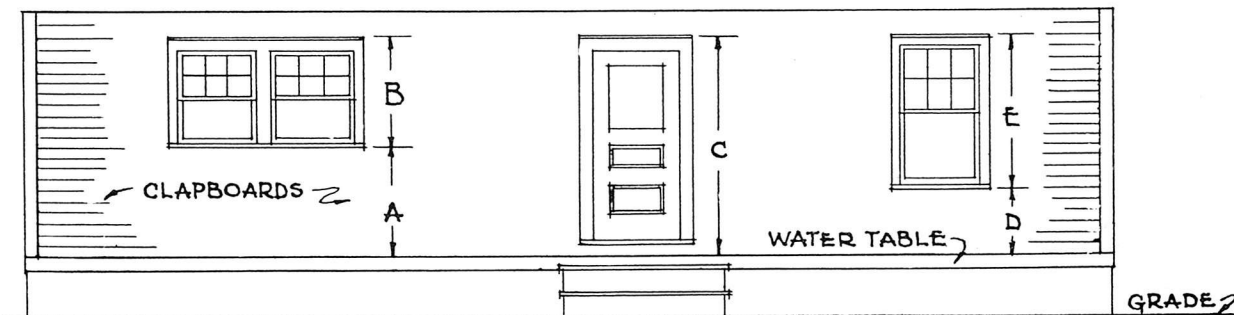


Fig. 2 REAR ELEVATION

E. DIVISION OF FRACTIONS

1. A board, 10" wide, is to be ripped up into strips $2\frac{5}{16}$ " wide. Allowing $\frac{3}{4}$ " for milling the strips, how many strips will there be?
2. How many pieces of board, each 2'-4" long, can be cut from a board 14'-0" long? Make no allowance for saw cuts.
3. In Figure 1, the front elevation of a lumber rack is shown. What is the width of the space marked "A" if the three spaces are of equal width?
4. What is the height of the space marked "B" in Figure 1, if all spaces are of equal height?
5. If $\frac{1}{4}$ " represents 1'-0" on a drawing, how many feet will be represented by $10\frac{1}{8}$ "?

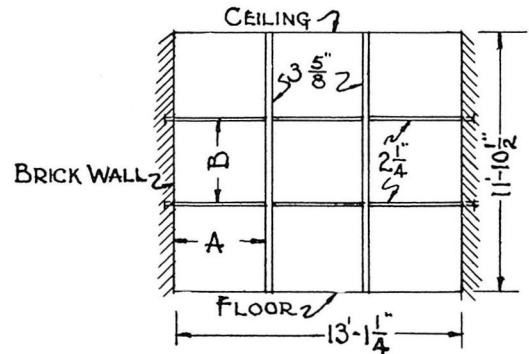


Fig. 1 LUMBER RACK

6. If we allow $2\frac{5}{8}$ " for the thickness of a course of brick, including the mortar joint, how many courses of brick will there be in a wall 3'-11 $\frac{1}{4}$ " high?
7. How many $7\frac{1}{2}$ " risers are there in a flight of stairs 7'-6" high?

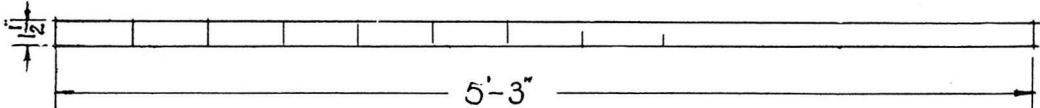


Fig. 2 SPACING POLE

8. A carpenter divided a spacing pole 5'-3" long, into 12 equal spaces. How long was each space? See Figure 2.
9. If the spacing pole shown in Figure 2, was 7'-0" long, and was to be "laid off" in spaces $4\frac{5}{8}$ " long, how many spaces would there be?
10. How many $6\frac{1}{8}$ " spaces would there be on a spacing pole 8'-2" long?
11. If the spacing pole in Figure 2, is 6'-4" long, and is laid off in spaces $4\frac{3}{4}$ " long, how many spaces would there be?
12. When $\frac{1}{8}$ " represents 1'-0" on a drawing, how many feet are represented by $6\frac{1}{2}$ "?
13. If a carpenter lays $10\frac{1}{2}$ squares of shingles in $4\frac{1}{2}$ days, how many squares of shingles does he average in a day?
14. How many $8\frac{3}{8}$ " risers are there in a flight of stairs 4'-11" high?

F. TEST NO. 1

1. Lath and plaster partitions separate the rooms of a house. If the partition studs are _____ thick and the lath and plaster on each face of the stud is _____ thick, what is the thickness of the partition?
2. A carpenter cut a piece of glass _____ long from a piece _____ long. What was the length of the piece of glass he had left?
3. From a piece of sheet lead _____ long, a carpenter cut the following lengths:- _____; _____; _____. What was the length of the piece of lead left?
4. A carpenter built a work bench _____ high. If the bench top was _____ thick, what was the height of the bench legs?
5. From a piece of board _____ long, a carpenter cut the following lengths:- _____; _____; _____; and _____. What was the length of the piece, allowing _____" for each cut?
6. If _____" on a drawing represents _____, how many inches on the drawing will be required to represent _____?
7. In building a tray, four pieces of wood _____" long are required. If we allow _____" for waste in cutting the pieces, how long must a board be to get out all four pieces?
8. A board is to be ripped into four strips. Each one must be _____ wide. Allowing _____" for waste in milling the stock, what width board should be used?
9. There are _____ treads, each having a run of _____, in a flight of stairs. What is the total run of the stairs?
10. What length of _____ material will be required to make _____ bench legs _____ long?
11. A board, _____" wide, is to be ripped up into strips _____" wide. Allowing _____" for milling the strips, how many strips will there be?
12. How many pieces of board, each _____ long, can be cut from a board _____ long? Make no allowance for saw cuts.
13. If _____" represents _____ on a drawing, how many feet will be represented by _____"?
14. If we allow _____" for the thickness of a course of brick, including the mortar joint, how many courses of brick will there be in a wall _____ high?

F. TEST NO. 2

1. How many _____ risers are there in a flight of stairs _____ high?
2. A carpenter divided a spacing pole _____ long, into _____ equal spaces. How long was each space?
3. How many _____ spaces would there be on a spacing pole _____ long?
4. A porch column must be _____ long. If the plinth is _____ " high, base _____ " high, and cap _____ " high, how long must the shaft (main part of column) be?
5. A certain kind of brick measures _____ " long, _____ " wide, and _____ " thick. These three factors multiplied together will give the volume in cubic inches. Find this volume.
6. A roof _____ ft. _____ in. wide is to be covered with boards which when laid cover a width of _____ ". How many widths of board will be needed?
7. A board weighs _____ pounds green but in drying the weight decreases _____. What does it weigh when dried?
8. A floor is laid by first putting down the rough sheathing which is _____ thick. On this are placed furring strips _____ thick and then the top or finish floor is laid which consists of boards _____ thick. What is the total thickness of this floor?
9. A lumber dealer has in stock _____ bundles of shingles. Of these _____ bundles are graded 16" white cedar and _____ are 18" red cedar. Each grade is what fractional part of the whole stock. Give the fractions in their lowest terms.
10. The actual face of a _____ flooring board is _____. A builder has on hand _____ pieces _____ ft. long. Will these cover a porch floor _____ ft. wide by _____ ft. long? How many pieces will be left over?
11. A man builds three houses which cost him a total of \$ _____. The first cost _____ of the whole, the second cost _____ of the whole and the third cost the remainder. What is the cost of each house?
12. A man puts in an eight hour day. _____ of the day he is employed in laying floor, _____ in setting bridge and the remainder in finishing. How many hours and minutes does he spend at each kind of work?

BLOCK III
DECIMALS

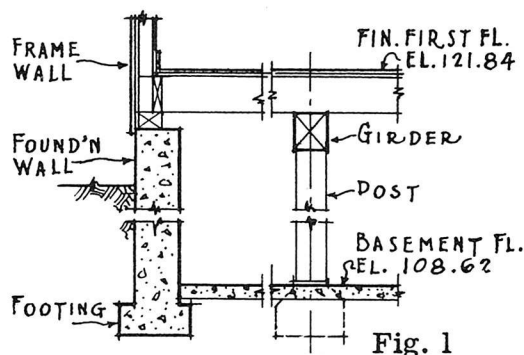
A. ADDITION OF DECIMALS

BLOCK III - SHEET 1

1. A contractor paid \$1,250.45 for frame lumber, \$650.34 for sash and trim, and \$156.20 for flooring. What was the cost?
2. A carpenter bought a door frame for \$4.50, a door for \$11.65, a lock for \$3.65 and hinges for \$.65. What was the total cost?
3. A contractor bought a window frame for \$3.68, sash for \$2.26, and trim for \$1.75. What was the total cost?
4. A home owner paid \$96.48 for 16 squares of shingles, \$6.72 for nails, and paid a carpenter \$48.00 for labor. What was the total cost of labor and material?
5. What was the total cost of the following order of material:-
130 lineal feet of 4" crown molding cost \$5.25.
700 lineal feet of 1" x 2" strapping cost \$7.30.
900 lineal feet of 1 1/2" bed molding cost \$9.25?
6. A carpenter paid \$120.25 for shingles, \$12.00 for nails and \$60.00 for labor. What was the total amount paid?
7. A carpenter built a bookcase and listed the cost of the following material:- whitewood \$1.52, wallboard \$.60, glue \$.05, nails \$.06, and labor \$1.50. What was the total cost?
8. A carpenter received \$460.25 for shingling a house, \$575.40 for building a veranda. What did he receive for both jobs?
9. A contractor paid \$1,906.42 for framing material and trim, \$65.50 for hardware, \$462.00 for masonry, \$170.35 for painting and the cost of his own labor \$850.67. What was the total cost of the items listed?
10. A contractor figured the material on a job to cost \$1,289.45, labor \$678.92, overhead \$69.45, and profit \$128.90. What figure did he submit to the owner?
11. A carpenter working on three jobs in a week collected from the first job \$12.36, the second \$13.42, and the third \$11.92. What was his week's pay?
12. A wood working mill made out an expense record for one week as follows:- material \$1,349.20, labor \$897.65, salaried help \$375.00 and overhead expenses \$275.45. What was the total expenses for the week?
13. In making a bid for a job, a contractor listed the following items:- material \$1,257.45, labor \$928.75, trucking the equipment to the job \$5.50, office overhead \$39.75 and profit \$235.50. What was the total bid that should have been submitted to the owner?

B. SUBTRACTION OF DECIMALS

1. A carpenter received \$482.60 for building a veranda; his material cost him \$304.78. What did he receive for his labor and profit?
2. A carpenter paid \$1,647.82 for material and received \$2,567.00 for the job. How much was his labor, assuming no other costs?
3. A white pine french door costs \$9.45. With bevel plate glass it would cost \$28.30. What is the cost of the bevel plate?
4. An outside door costs \$19.15 glazed with D. S. (double strength) glass and \$24.10 with bevel plate glass. Give the difference in price.
5. A carpenter received \$421.25 for laying some floors. The nails and flooring cost \$257.60. What was his labor and profit?
6. A carpenter estimated the cost of purchasing and installing a china cabinet at \$70.95. If the price of the cabinet was \$51.45 delivered at the job complete, how much did he receive for labor?
7. An estimated figure of \$1,250.75 was submitted for a job. When the job was completed, the material actually cost \$495.42, and the labor and overhead came to \$596.36. What did the contractor make on the job?
8. The labor for milling some stock totaled 34.75 hours and was charged to three different jobs. To the first job 24.5 hours were charged; to the second job 3.25 hours. How much time was charged on the third job?
9. The basement elevation for a building being erected is 108.62 ft. and the first floor elevation is 121.84 ft. What length must a carpenter cut a post to support a girder, if the distance from the top of the first floor to the underside of the girder is 2'-0" and there is a cast iron base plate 1" thick under the post? See sectional detail at the right.
10. What would be the dimension in feet and inches from the basement floor to the first floor, in Figure 1, if the elevation of the first floor were 286.86' and basement 272.91'?
11. In a mill, four jobs totaled 146 hours. Of the 146 hours, 26.75 were charged to job no. 1, 46.25 to job no. 2, and 39.25 to job no. 3. The carpenter forgot to record the hours on job no. 4. How much should he have recorded for it?



SECTIONAL DETAIL

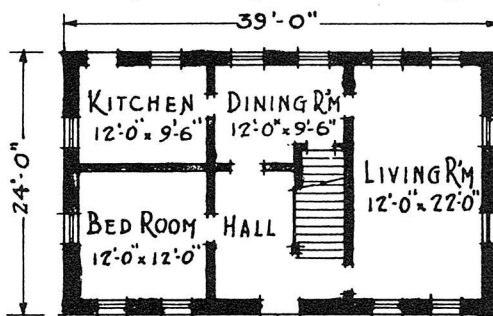
C. MULTIPLICATION OF DECIMALS

NOTE: IN EXACT COST FINDING, TIME IS FREQUENTLY FIGURED TO 1/10 HOUR

1. A man turned four veranda posts in 5.2 hours at a rate of \$1.15 per hour. What was the cost of his labor?
2. Figure the labor cost on 23 window screens if each screen takes .8 hour to build and the hourly labor rate is \$.85.
3. The time for laying shingles was estimated to be 2.7 hours per square, if laid 5" to the weather. What would be the estimated labor cost for laying 18 squares of shingles 5" to the weather, at \$1.25 per hour?
4. Finish flooring was estimated to take 3.2 hours per 100 square feet, (one square). At that rate, how much time would it take to lay a floor 15.3 squares in area?
5. Figure the labor cost of laying the floor in Problem 4, at a rate of \$1.25 per hour.
6. It takes .4 of an hour to lay 100 sq. ft. of deadening felt strips. What is the labor cost per 100 sq. ft. at a rate of \$1.25 per hour?
7. The labor for placing deadening felt or quilt over rough floors is .4 of an hour per square. Figure the cost of laying 20.5 squares at a rate of \$1.25 per hour.
8. Laying shingles 6" T. W. on an irregular roof is estimated to take 2.6 hours per square. How long will it take to lay 14.4 squares?
9. If a carpenter gets \$1.25 per hour, for laying the shingles in Problem 8, figure the labor cost.
10. The material needed for a veranda floor is estimated to be 81.9 board feet and the cost of 1" stock for this job is \$.075 a board foot. What did the carpenter pay for the material?
11. Hanging a single sash in a building takes .3 of an hour. What will be the labor cost to hang 15 sash at a rate of \$1.25 per hour?
12. The fitting of a casement sash of a certain size takes an average of .375 hour. What is the labor cost of fitting 26 such sash at \$1.25 per hour?
13. A carpenter should lay 100 sq. ft. of deadening felt over a sub-floor in .4 of an hour. How much time should it take to lay 55.25 squares?
14. If the labor cost of laying the deadening felt in Problem 13, is \$1.25 per hour, what is the labor charge?

D. DIVISION OF DECIMALS

1. The cost of purchasing and laying 21 squares of asphalt shingles was \$242.75. Compute the cost per square.
2. A contractor purchased 4500 bd. ft. (board feet) of timber for \$202.50. What was the cost per thousand bd. ft.?
3. A bill of \$99.60 was received by a contractor for 2490 bd. ft. of lumber. What was the cost per thousand?
4. A contractor was quoted a price of \$199.50 for 2100 bd. ft. of lumber. What was the cost per thousand?
5. Asphalt shingles can be purchased by the square and in fractions of $\frac{1}{3}$ or $\frac{2}{3}$ of a square. An order of $22 \frac{1}{3}$ squares of these shingles cost \$120.60. What was the cost per square?
6. The payroll on a certain job employing 5 carpenters was \$229.00. After completing the job the contractor finds they each worked 35.5 hours. What was the hourly rating, if each man received the same wages?
7. A carpenter received \$145.00 for labor on a front porch. After completing the job, he found he worked a total of 116.5 hours on the job. What was his pay per hour?
8. After laying the finished floor in the Living Room shown on the floor plan below, the carpenter figured his material and labor amounted to \$95.55. What was the cost per square? Note: A square equals 100 sq. ft.



FLOOR PLAN

9. The Dining Room and Bedroom floors shown in the above plan were laid with select oak flooring. If the labor for both rooms was \$40.82, and the material \$56.30, what was the cost per square for the floors? Disregard the offset in Dining Room.
10. Linoleum to finish the Kitchen floor cost \$30.75 for labor and material. What was the cost per square?

E. CHANGING FRACTIONS TO DECIMALS

NOTE:- IN THE FOLLOWING PROBLEMS, YOU ARE TO CHANGE THE COMMON FRACTIONS TO DECIMALS AND THEN SOLVE.

1. If the rate of wages for a carpenter is \$1.12 $\frac{1}{2}$ per hour and he works 37 $\frac{1}{4}$ hours in one week, what will his wages amount to?
2. The exterior wall of a house is 9'-10 $\frac{3}{4}$ " high. If it is to be covered with clapboards spaced 4 $\frac{3}{4}$ " to the weather, how many courses will there be on the wall?
3. 16 $\frac{1}{4}$ squares of composition shingles were purchased at \$7.75 a square. What was the total cost of the shingles?
4. If it costs \$3.75 to lay one square of asphalt shingles, what will it cost to lay 18 $\frac{1}{2}$ squares of asphalt shingles?
5. To sand a floor a price of \$0.06 $\frac{1}{2}$ per square foot was given. If the floor contains 166 $\frac{3}{4}$ square feet of surface, what was the cost of sanding the floor?
6. How many stair risers 7 $\frac{5}{8}$ " high will there be in a stair-case that is 9'-6 $\frac{3}{8}$ " high?
7. How many 7 $\frac{7}{8}$ " risers will there be in a stair-case that is 9'-10 $\frac{1}{8}$ " high?
8. If the rate of wages for a carpenter's helper is \$.62 $\frac{1}{2}$ per hour, what amount will he receive for 39 $\frac{3}{4}$ hours?
9. A carpenter bought 12 $\frac{1}{4}$ squares of asphalt shingles at \$7.85 a square. What was the entire cost of the shingles?
10. A carpentry foreman receives \$1.37 $\frac{1}{2}$ per hour for wages. What amount will he receive for 36 $\frac{3}{4}$ hour's work?
11. If the exterior wall of a house is 15'-6 $\frac{1}{4}$ " high and is to be covered with wooden shingles laid 8 $\frac{3}{8}$ " to the weather. How many courses of shingles will there be?
12. A spacing pole 5'-11 $\frac{1}{4}$ " long is to be laid off in spaces 4 $\frac{3}{4}$ " long. How many spaces will there be?
13. If the spacing pole is 9'-2 $\frac{1}{4}$ " long and is to be laid off in spaces 5 $\frac{1}{4}$ " long, how many spaces will there be?
14. A spacing pole is 6'-2 $\frac{3}{4}$ " long and is to be laid off in spaces 5 $\frac{3}{4}$ " long. How many spaces are there on the pole?

F. CHANGING DECIMALS TO FRACTIONS

NOTE:- A SET OF RAFTER TABLES IS LOCATED ON THE FACE OF THE BODY OF A STEEL SQUARE. THE TABLES ON THE FIRST FOUR LINES HAVE BEEN MADE UP IN INCHES AND HUNDREDTHS OF AN INCH. FOR PRACTICAL USES THE CARPENTER MUST CONVERT THESE FIGURES SO THAT THEY WILL AGREE WITH THE GRADUATIONS ON HIS RULE AND TAPE.

1. Figure 1, shows a portion of the blade of a steel square. Below the 8" mark on the top row, the figure 14.42" is given. Change this figure to feet, inches and the fractional part of an inch.

9	8	7	6	5	4
15 00	14 42	13 89	13 42	13 00	12 65
19 21	18 76	18 36	18 00	17 69	17 44
20	19 23	18 52	17 875	17 33	16 87
30	28 84	27 78	26 83	26	25 30
9 5/8	10	10 3/8	10 3/4	11 1/16	11 3/8
10 5/8	10 7/8	11 1/16	11 5/16	11 1/2	11 11/16
8	7	6	5	4	3

Fig. 1

2. Below the 7" mark in Figure 1, 13.89" is located in the top row of the tables. Change this figure to feet and inches.
3. On the second row of the tables under the 9" mark in Figure 1, 19.21" is given as a diagonal. Convert this figure to feet and inches.
4. In the jack rafter tables listed on the third row of the square in Figure 1, we find 18.52" located under the 7" mark. How many feet and inches does this represent?
5. In the hip rafter table on the second row under the 8" mark, we find a length of 18.76" given. Convert these figures into inches and the fractional part of an inch.

F. CHANGING DECIMALS TO FRACTIONS

1. In Figure 1, under the 14" mark in the jack rafter table, 24.585" is given. Change this figure to feet and inches.

14	13	12	11	10
18.44	17.69	16.97	16.28	15.62
22.00	21.38	20.78	20.22	19.70
24.585	23.588	22.625	21.704	20.83
36.88	35.38	33.94	32.56	31.24
7 ¹³ / ₁₆	8 ¹ / ₈	8 ¹ / ₂	8 ⁷ / ₈	9 ¹ / ₄
9 ³ / ₈	9 ⁵ / ₈	9 ⁷ / ₈	10 ¹ / ₈	10 ³ / ₈
13	12	11	10	9
8				

Fig. 1

2. Under the 12" mark, in Figure 1, reading in the third row on the square, 22.625" is shown. What would this be, in feet and inches.
3. In the fourth row, under the 13" mark, convert the figures given, into feet and inches.
4. How many feet and inches are there in each figure given under the 11" mark, in Figure 1?
5. Figure 2, shows a section of the brace tables given on the back of the blade of steel square. On the center of the blade under the 8" mark, find 67.90". How many feet and inches does this figure contain?

8	7	6	5	4	3
48 67 90	51 72 12	54 76 37	57 80 61	60 84 85	18 24
6	5	4	3	2	1

Fig. 2

6. Figure 2, under the 6" mark, we find $\frac{54}{54}$ 76 $\frac{37}{54}$. This means that if two sides of a square are 54" (or 54 ft.) in length, the diagonal line across this square will measure 76.37", (or 76.37 ft.). What will this be, in feet and inches?
7. Under the 5" mark in Figure 2, what is the length given us, in feet and inches, for the diagonal of a 57" square?
8. Give the length of the diagonal of a 60" square, in feet and inches, by consulting Figure 2.

G. CHANGING FRACTIONS TO DECIMALS

1. If the elevation at the top of the concrete slab in Figure 1, is 127.75 ft., what will be the elevation at the top of the cork tile floor, if the tile is $1\frac{1}{2}$ " and the cement finish is $1\frac{1}{4}$ " thick?

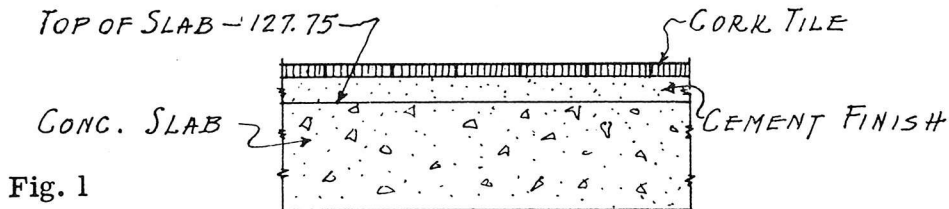


Fig. 1

2. Figure the elevation for the cork tile floor in Figure 1, if the tile is $\frac{3}{16}$ " and the cement finish elevation is 141.23 ft.
3. Two cement finishes are to be put on top of the concrete slab in Figure 1. If they total $\frac{3}{4}$ " in thickness, what will be the finished floor elevation, if the concrete slab elevation is 113.45 feet?

4. The elevation at the top of the girder in Figure 2, is 171.46 feet. Figure the elevation of the top of the $\frac{7}{8}$ " wood floor.

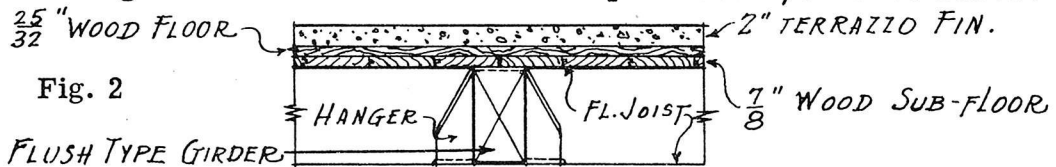


Fig. 2

5. If the top of the girder in Figure 2, is 156.92 feet in elevation, what is the elevation of the top of the $\frac{25}{32}$ " wood floor?
6. Figure the elevation at the top of the terrazzo floor in Figure 2, if the elevation at the top of the girder is 127.95 feet.
7. In setting form work to pour the finish on a sidewalk a carpenter was told to raise the form $\frac{3}{4}$ " above an elevation of 141.35 feet. What was the new elevation?

8. At what elevation must the concrete setting bed, Figure 3, be laid to obtain the required elevation at the top of the tile floor. (See drawing).

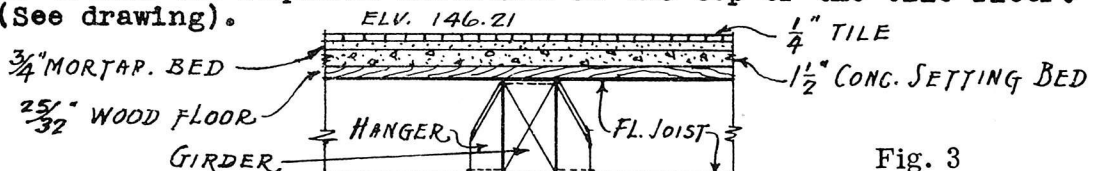


Fig. 3

9. Figure the elevation for the top of the $\frac{25}{32}$ " wood floor in Fig. 3.
10. What is the elevation at the top of the girder in Figure 3?

H. TEST NO. 1

1. A contractor paid \$_____ for frame lumber, \$_____ for sash and trim, and \$_____ for flooring. What was the cost of material?
2. A home owner paid \$_____ for _____ squares of shingles, \$_____ for nails, and paid a carpenter \$_____ for labor. What was the total cost of labor and material?
3. What was the total cost of the following order of material:-
_____ lineal feet of _____ crown molding cost \$_____,
_____ lineal feet of _____ strapping cost \$_____,
_____ lineal feet of _____ bed molding cost \$_____?
4. A contractor paid \$_____ for framing material and trim, \$_____ for hardware, \$_____ for masonry, \$_____ for painting and the cost of his own labor \$_____. What was the total cost of the items listed?
5. A wood working mill made out an expense record for one week as follows:- material \$_____, labor \$_____, salaried help _____ and overhead expenses \$_____. What was the total expenses for the week?
6. In making a bid for a job, a contractor listed the following items:- material \$_____, labor \$_____, trucking the equipment to the job \$_____, office overhead \$_____ and profit \$_____. What was the total bid that should have been submitted to the owner?
7. A carpenter received \$_____ for building a veranda; his material cost him \$_____. What did he receive for his labor and profit?
8. A white pine french door costs \$_____. With bevel plate glass it would cost \$_____. What is the cost of the bevel plate?
9. An estimated figure of \$_____ was submitted for a job. When the job was completed, the material actually cost \$_____, and the labor and overhead came to \$_____. What did the contractor make on the job?
10. The time for laying shingles was estimated to be _____ hours per square, if laid _____ " to the weather. What would be the estimated labor cost for laying _____ squares of shingles _____ " to the weather, at \$_____ per hour?
11. The material needed for a veranda floor is estimated to be _____ board feet and the cost of _____ " stock for this job is \$_____ a board foot. What did the carpenter pay for the material?
12. Hanging a single sash in a building takes _____ of an hour. What will be the labor cost to hang _____ sash at a rate of \$_____ per hour?

H. TEST NO. 2

1. The fitting of a casement sash of a certain size takes an average of _____ hour. What is the labor cost of fitting _____ such sash at \$ _____ per hour?
2. A carpenter should lay _____ square feet of deadening felt over a sub-floor in _____ of an hour. How much time should it take to lay _____ squares?
3. The cost of purchasing and laying _____ squares of asphalt shingles was \$ _____. Compute the cost per square.
4. A contractor purchased _____ bd. ft. (board feet) of timber for \$ _____. What was the cost per thousand bd. ft.?
5. Asphalt shingles can be purchased by the square and in fractions of _____ or _____ of a square. An order of _____ squares of these shingles cost \$ _____. What was the cost per square?
6. The payroll on a certain job employing _____ carpenters was \$ _____. After completing the job the contractor finds they each worked _____ hours. What was the hourly rating, if each man received the same wages?
7. A carpenter received \$ _____ for labor on a front porch. After completing the job, he found he worked a total of _____ hours on the job. What was his pay per hour?

NOTE:- IN THE FOLLOWING PROBLEMS, YOU ARE TO CHANGE THE COMMON FRACTIONS TO DECIMALS AND THEN SOLVE.

8. The exterior wall of a house is _____ high. If it is to be covered with clapboards spaced _____ to the weather, how many courses will there be on the wall?
9. To sand a floor a price of \$ _____ per square foot was given. If the floor contains _____ square feet of surface, what was the cost of sanding the floor?
10. How many stair risers _____ high will there be in a staircase that is _____ high?
11. The elevation given on a plan at the top of a second floor joist is 123.86 feet. If above these joists there is a rough floor of $1\frac{3}{4}$ " stock and a finish floor of $\frac{7}{8}$ " hard pine, what will be the elevation of the finish floor when completed?
12. The elevation given at the top of a foundation wall for a school building is given as 165.24 feet. If the plan shows a window sill located 64'-3" above the foundation, what will be the elevation of this window sill?

BLOCK IV
PERCENTAGE

A. PERCENTAGE (SIMPLE)

BLOCK IV - SHEET 1

1. A carpenter figures the area of a veranda floor to be 280 sq. ft. To this figure he must add 25% for waste and matching, in order to find the number of bd. ft. of $7/8$ " flooring to order. How many should he order?
2. How many Bd. Ft. of 1" x 6" matched boards will be required to lay a sub floor in a house that is 28'-0" x 26'-0"? Add 20% to the area for waste and matching.
3. Two sub floors in a building 24'-0" x 45'-0" are to be laid diagonally. How many bd. ft. of 1" x 8" sheathing must be used if 25% is allowed for waste and matching?
4. On a residence, 2% of the total cost was figured for excavation. How much money was allowed for this part of the work, if the house cost \$6,890.00?
5. The carpentry and mill work on a new residence amounted to \$1,756.00. A contractor figures 68% of this amount as the cost of material and the remaining 32% for labor. What is his material and labor figure in dollars and cents?
6. A contractor figures a job to cost \$15,000.00 of which 12% is profit. How much, in dollars, does he allow for profit?
7. A general contractor estimates a non-residential building to cost \$25,860.00. If the work of excavating and grading is 3% of this amount, concrete work 20% and carpentry 9%, what is the amount estimated for each of these three items?
8. Figure the percentage spent on carpentry, labor, and material, if the total for this item was \$1,896.50 and the total cost of the house was \$6,000.00.
9. On a non-residential building 6% of the total job cost was for carpentry labor. If the job figured \$15,000.00, what was the cost for carpentry labor?
10. The carpentry labor and material on a residential building was estimated to be \$1,927.50. If 32% of this amount was for labor and 68% was for material, what was the allowance for labor? What was the allowance for material?
11. The grading on a \$6,500.00 house came to \$112.50. What percent was this of the total cost?
12. A contractor purchased 17,500 Bd. Ft. of rough lumber. In having it milled he figures on losing 18% as waste. How many Bd. Ft. of lumber does he actually obtain?
13. A certain grade of lumber is supposed to be 75% "Clear" or free from knots and other defects. How much clear lumber should a carpenter find in a load of 2200 Bd. Ft.?

B. INTEREST

1. A man borrowed \$4,500.00 at a rate of 6% on a bank mortgage for the construction of a house. What was the yearly interest paid on the mortgage?
2. A carpenter deposited \$192.80 in a savings bank. If the bank pays 4 1/2% interest per year, payable annually, what was the total amount he had in his account at the end of one year?
3. A contractor secures a bond of \$2,500.00 at a rate of 2% for one month. If he uses this bond for four months, how much does the bond cost him for that period?
4. A contractor gives a bank note for \$7,550.00 at a rate of 2% for one month. If he uses this money for three months, how much interest must he pay?
5. A hardware company adds 3 1/2% to bills that are not paid within a 30 day period. If a carpenter is unable to pay his bill of \$70.80 until after the 30 days, what was the total charge of the bill?
6. A bank loaned \$4,250.00 to a contractor at a rate of 6% per year. What was the yearly interest payment?
7. A lumber yard levies a 6% interest charge on money owed them after 30 days. What interest will a contractor have to pay on a \$1,876.60 bill if he pays his in 90 days?
8. A contractor has \$3,755.00 deposited in a 2% interest drawing account. If interest is paid every six months and no withdrawals are made, how much money will he have in the bank at the end of three years? Note: This is compound interest and is figured by finding the simple interest for the first interest period (six months in this case). Add this to the principal and figure the second interest period and so on for each period.
9. Figure the interest on \$1,000.00 at 4% to be compounded yearly for a period of 15 years.
10. Owing to a shortage of ready cash a contractor is obliged to use some of the money in his personal bank account. If he had \$1,928.50 deposited at a rate of 2 1/2% and it had been there for 3 years, figure the exact amount he can draw out, if it has been compounded annually.
11. A carpenter deposits a sum of money in a savings account each year for three years. The first year he deposits \$175.00; the second year \$225.00; and the third year \$375.00. If the bank pays 2% semi-annually, how much did he have in his account at the end of the third year?

C. DISCOUNT

1. The list price of a steel square in a catalog is \$4.50, subject to a 25 discount. What is the net price of the square?
2. If a contractor orders material that costs \$1,926.90 less 2% for 30 days and pays for it in ten days after ordering, what is the amount of the bill that he paid?
3. A No. 55 plane is listed at \$34.40. A carpenter purchases it at list, less 30%. What did he pay for the plane?
4. A carpenter purchases an aluminum mitre box listed at \$37.30, less 33 1/3%. What did he pay for the box?
5. The list price of a table saw is \$450.00, less 20% and 10%. What is the actual cost to a carpenter who can obtain the above discounts?
6. If a contractor purchases oak lumber for \$1,400.00, less 2% discount, yellow pine for \$ 596.00, less 2%, white pine for \$896.50, less 1%. What was the total amount of the bill?
7. A contractor receives the following bill and pays it within 30 days, thus receiving an extra discount of 2%. What amount did he pay?
 17 oak treads and risers \$10.25, less 2%.
 6 newel posts 6.75, less 1%.
 200 balusters 20.00, less 2%.
8. A catalog quotation on a bill of mill work amounts to \$1,241.50. If the firm allows a discount of 2% and 1%, how much did a carpenter have to pay for this material?
9. A tool cabinet containing 48 tools is listed for \$95.00. A carpenter is allowed a discount of 15% and 10% and if he will pay cash within 30 days, he is allowed an additional discount of 5%. What is the cost of the set if he takes advantage of the discounts offered?
10. A carpenter obtains a price on storm windows of \$2.91 each. How much must he pay for 12 windows if he gets a wholesale discount of 5% and 2%?
11. A contractor gets a job to furnish breakfast sets at \$26.25 each. He wishes to know whether it is cheaper to buy these already made up at a 2% and 1% discount or to make them up himself. If he can make them up for \$25.75 each, which is the cheaper. and how much?
12. A contractor gets the following bill from a mill:-
 Six, 2'-8" x 6'-8" door frames at \$5.50 less 1%.
 One, 2'-8" x 6'-8" white pine door at \$15.77 less 2%.
 One, 3'-0" x 6'-8" colonial white pine door at \$17.49 less 2%.
 If he gets a 2% cash discount, what did he pay for the stock?

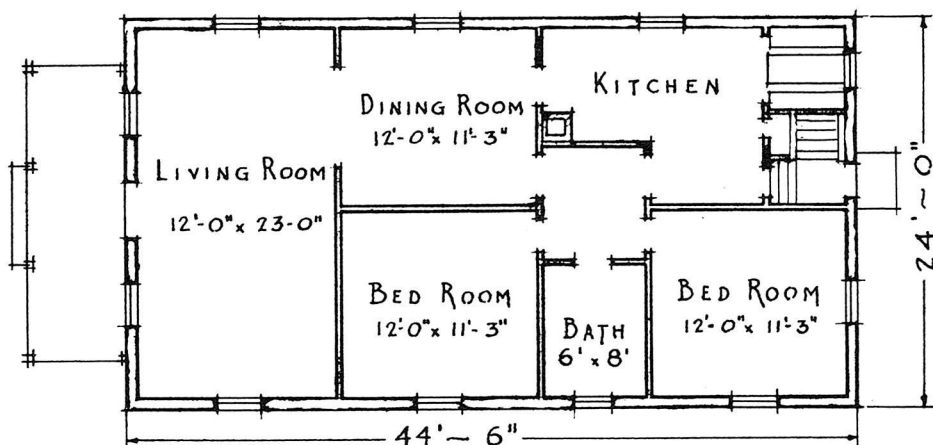
D. TEST

1. A carpenter figures the area of a veranda floor to be _____ sq. ft. To this figure he must add _____% for waste and matching, in order to find the number of bd. ft. of _____" floor to order. How many should he order?
2. Two sub floors in a building _____ are to be laid diagonally. How many bd. ft. of _____ sheathing must be used if _____% is allowed for waste and matching?
3. The carpentry and mill work on a new residence amounted to \$ _____. A contractor figures _____% of this amount as the cost of material and the remaining _____% for labor. What is his material and labor figure in dollars and cents?
4. A general contractor estimates a non-residential building to cost \$ _____. If the work of excavating and grading is _____% of this amount, concrete work _____%, and carpentry _____%, what is the amount estimated for each of these three items?
5. A contractor purchased _____ bd. ft. of rough lumber. In having it milled he figures on losing _____% as waste. How many bd. ft. of lumber does he actually obtain?
6. A certain grade of lumber is supposed to be _____% "Clear" or free from knots and other defects. How much clear lumber should a carpenter find in a load of _____ bd. ft.?
7. A hardware company adds _____% to bills that are not paid within a _____ day period. If a carpenter is unable to pay his bill of \$ _____ until after the _____ days, what was the total charge of the bill?
8. A lumber yard levies a _____% interest charge on money owed them after _____ days. What will a contractor have to pay on a \$ _____ bill, if he pays his in _____ days?
9. Owing to a shortage of ready cash a contractor is obliged to use some of the money in his personal bank account. If he had \$ _____ deposited at a rate of _____% and it had been there for _____ years, figure the exact amount he can draw out, if it had been compounded annually.
10. A carpenter deposits a sum of money in a savings account each year for three years. The first year he deposits \$ _____; the second year \$ _____; and the third year \$ _____. If the bank pays _____% semi-annually, how much did he have in his account at the end of the third year?
11. A catalog quotation on a bill of mill work amounts to \$ _____. If the firm allows a discount of _____% and _____%, how much did a carpenter have to pay for this material?

BLOCK V
WEIGHTS AND MEASURES

A. MEASURES (LINEAR AND SQUARE)

BLOCK V - SHEET 1

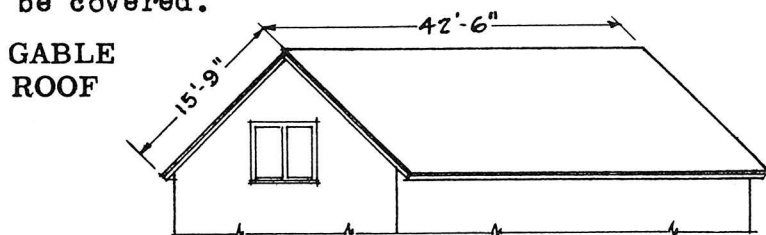


FIRST FLOOR PLAN

1. What is the perimeter of the Living Room of the house the plan of which is shown above?
2. What is the perimeter of the outside walls of this house?
3. How many sq. ft. (square feet) of floor surface are there in the Living Room?
4. Find number of sq. ft. of floor surface in the Dining Room.
5. The term "square" which is used extensively in the building trades means 100 square feet. How many squares of floor surface are there in the Living Room?
6. In estimating the amount of finished flooring a carpenter can lay, the number of squares contained in the area to be floored is figured. How many squares are there in the Dining Room floor shown above?
7. Lathing is figured by the square yard. How many square yards of wall surface are to be lathed in the Living Room of the house in Figure 1, if the walls are 8'-0" high? Deduct 70 sq. ft. for door and window openings.
8. How many sq. yds. of ceiling surface must be lathed in the Living Room?
9. The Dining Room walls are 8'-0" high. How many sq. yds. of wall and ceiling surface must be lathed? Deduct 52 sq. ft. for door and window openings.
10. How many sq. ft. of floor surface are there in the entire first floor of this house? Make no allowance for interior partitions but allow 6" for the thickness of the outside wall. Deduct 40 sq. ft. for the stair well.

B. MEASURES (SQUARE)

1. Figure the cost of sanding a dining room floor which measures 12'-0" wide and 12'-6" long at 6¢ per sq. ft. of floor surface.
2. Ten pieces of sheetrock each measuring 4'-0" in width and 8'-0" in length were purchased at a cost of 4 1/2¢ a sq. ft. What was the total cost of the ten pieces?
3. Both sides of the roof shown in the sketch are to be covered with asphalt shingles. Find the number of sq. ft. of surface to be covered.



4. How many sq. ft. of surface would there be on the roof shown in the sketch, if the ridge was 33'-9" long?
5. A bathroom 6'-6" wide and 7'-10" long is to have the four sidewalls covered with metal lath to a height of 4'-6". If an allowance of 15 sq. ft. is made for door and window openings, how many sq. yds. of wall surface would there be to cover?
6. The bathroom in Problem 5, is to have a tile floor. Figure the number of sq. ft. of floor surface that is to be covered.
7. 38 pieces of copper flashing each measuring 5" wide and 8" long, are required for a roof. How many sq. ft. of copper must be purchased?
8. The four sidewalls of a room 14'-6" wide and 17'-8" long are to be paneled to a height of 5'-6". If deduction of 27 sq. ft. is made for door and window openings in the room, how many sq. ft. of wall surface are there to be covered?
9. How many sq. yds. of ceiling surface are there in the room in Problem 8?
10. What will be the cost of 32 pieces of sheetrock 4'-0" wide and 8'-0" long at a unit cost of 4 1/2¢ a sq. ft.?
11. 12 pieces of veneered plywood each measuring 17" wide and 21 1/2" long were used for the backs of cabinets. What was the actual number of sq. ft. of plywood used in the cabinets?
12. Figure the number of sq. ft. of surface in a concrete sidewalk 4'-10" wide and 65'-6" long.

C. MEASURES (CUBIC)

- Figure 1, shows a section of concrete foundation wall. How many cubic yards of concrete does it contain?

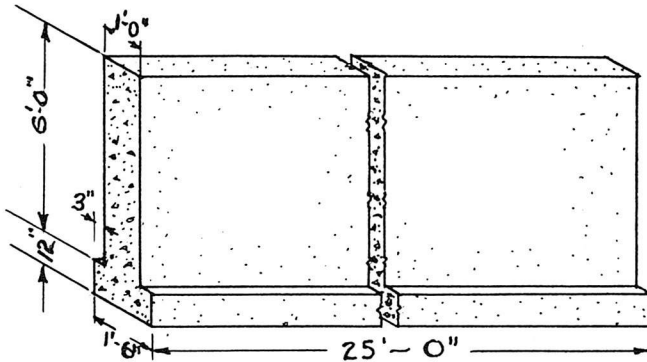


Fig. 1

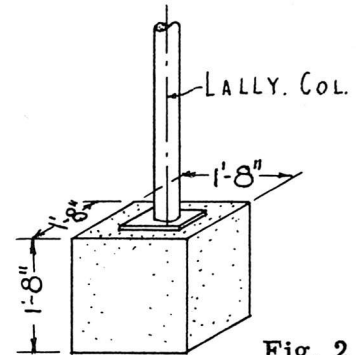


Fig. 2

- A house 25'-0" by 44'-6" outside measurement has foundation walls whose sectional dimensions are the same as in the diagram above. If the walls are supported on the same size footings, how many cubic yards of concrete are there in the foundations?
- How many cubic yards of concrete are necessary to pour eight footings 20" x 20" x 20" for lally columns? See Figure 2.
- If the foundation walls of the house given in Problem 2, were to be built with rubble stone 16" thick with no footing under them, how many cubic yards of stone would be required for the job?
- How many perch of stone would be required for Problem 4? (1 perch = $24 \frac{3}{4}$ cubic feet.)
- Figure 3, shows a cross section of a concrete side walk. How many cubic yards of earth does it displace, if the walk is 40'-0" long?

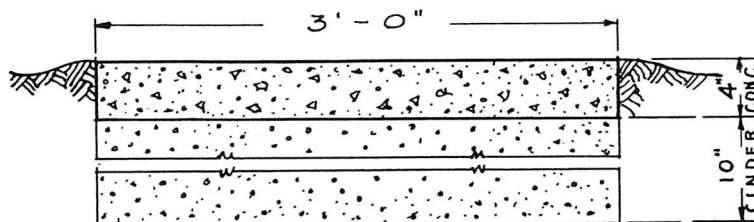


Fig. 3

- How many cubic yards of concrete are there in the side walk described in Problem 6?
- How many cubic yards of cinders are there beneath the side walk?

D. BOARD MEASURE



THE BASIC RULE FOR FINDING BOARD MEASURE IS TO MULTIPLY THE LENGTH IN FEET BY THE WIDTH IN FEET BY THE THICKNESS IN INCHES. FOR A THICKNESS IN FRACTIONS OF AN INCH IT IS GENERAL PRACTICE TO CONSIDER THE FRACTION AS A FULL INCH, THE ONLY USUAL EXCEPTIONS BEING NOMINAL THICKNESSES OF $1\frac{1}{4}$ INCH AND $1\frac{1}{2}$ INCH.

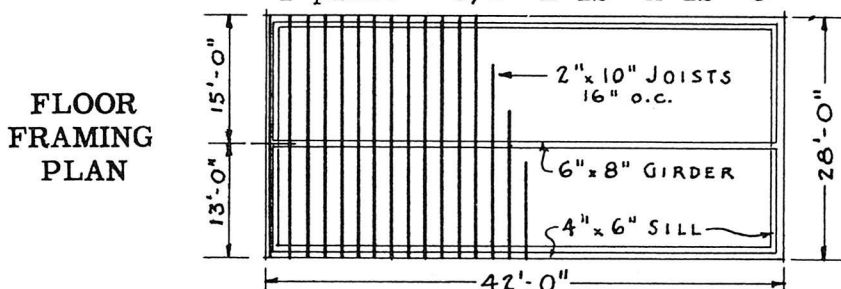
1. If a board is 8" wide, 1" thick and 16'-0" long, how many bd. ft. does it contain?
2. Figure the bd. ft. in a board 1" x 4" x 16'-0" long.
3. Find the number of bd. ft. in a joist 2" x 12" x 18'-0".
4. How many bd. ft. of lumber are there in forty-four 2" x 8" floor joists 14'-0" long?
5. What is the B.M. of 116 pieces of 2" x 4" studding 16'-0" long?
6. Find the number of bd. ft. of lumber in 8 pieces of 4" x 6" sills 24'-0" long.
7. The 6" x 8" fir girder which supports one end of the floor joists of a house is 32'-0" long. How many bd. ft. does it contain?
8. There are forty-four 2" x 6" roof rafters 16'-0" long in a building. How many bd. ft. do they contain?
9. The exterior walls of a building have 131 pieces of 2" x 4" studding 9'-0" long. How many bd. ft. of lumber are there in the studding?
10. A contractor ordered a list of lumber in the following sizes. Figure the number of board feet of stock in the order:

15 pieces 2" x 10" x 14'-0"
 15 pieces 2" x 10" x 16'-0"
 14 pieces 2" x 8" x 14'-0"
 14 pieces 2" x 8" x 16'-0"
 42 pieces 2" x 4" x 18'-0"

D. BOARD MEASURE

- Figure the total number of Bd. Ft. of select sugar pine in the following list:-

10 pieces $5/4"$ x $4"$ x $16'-0"$
 6 pieces $5/4"$ x $10"$ x $18'-0"$
 1 piece $5/4"$ x $12"$ x $12'-0"$



- How many Bd. Ft. of lumber are required for the girder shown on the floor framing plan above, if a foot in length is added for splicing?
- Sill stock is sold in multiples of $2'-0"$ in length. Find the number of board feet of lumber to be ordered for the two sills that run at right angles to the floor joist if one foot in length is added for splicing. Refer to the plan above.
- Figure the board feet of stock to be ordered for each floor joist running across the $13'-0"$ span. Floor joists are sold in multiples of $2'-0"$.
- How many board feet of stock are to be ordered for all of the floor joists for the $13'-0"$ span on the framing plan. To find the number of joists required divide the distance by the spacing and add one (1) for a starter.
- Figure the board feet of stock to be ordered for the two $4"$ x $6"$ sills that run parallel to the floor joist on the framing plan. Most lumber yards carry $4"$ x $6"$ sills $28'-0"$ long in stock.
- Find the number of board feet that must be ordered for each floor joist running across the $15'-0"$ span on the framing plan.
- How many board feet of lumber would you order for all of the floor joists running across the $15'-0"$ span?
- Compute the number of board feet of sub-flooring to be ordered for the entire floor surface on the floor framing plan. $1"$ x $6"$ matched boards are to be used. The board feet to be ordered is found by determining the area and adding 20% for matching and waste.
- How many board feet of $1"$ x $3"$ oak flooring must you order for the entire floor on the plan if an allowance of 38% is made for waste and matching?

E. MEASURES (MISCELLANEOUS)

NOTE:- THE QUANTITIES OF MATERIALS NECESSARY TO MAKE ONE CUBIC YARD OF CONCRETE FOR THE THREE MIXTURES OF CONCRETE MOST COMMONLY USED FOR ORDINARY WORK ARE GIVEN IN THE TABLE BELOW. THE VOIDS OR SPACES BETWEEN THE BROKEN STONE TAKE UP MOST OF THE SAND AND CEMENT AND THIS ACCOUNTS FOR THE SURPLUS OF MATERIAL OVER THE ACTUAL CONTENT OF A CUBIC YARD (27 cu. ft.)

Material Table

Mixture	Cement in bags.	Sand (Cu. Ft.)	Crushed Stone (Cu. Ft.)
1:2:4	6	12	24
1:2½:5	5	12½	25
1:3:6	4½	12½	25

- Find the quantity of materials required for a concrete floor 26'-6" x 32'-0" x 4", using a 1:2:4 mix.
- A concrete wall is 125'-0" long, 18'-0" high and 3'-0" thick. Find the quantities of materials that must be ordered for this wall if a 1:3:6 mixture is used.
- A concrete foundation wall that supports one side of a house is 45'-0" long, 7'-0" high and 12" thick. If a 1:2½:5 mixture is used, what amounts of materials must be ordered?
- A concrete floor in a garage is 19' x 19' x 4". Find the quantity of materials for a 1:2:4 mixture.
- When bank run gravel is used in concrete work, about 1¼ cubic yards of gravel are required to make one cubic yard of concrete. How many cubic yards of bank run gravel will be required for a concrete wall 26'-6" long, 7'-6" high and 12" thick?
- Figure the quantities of materials for a concrete driveway 42'-8" x 6' x 4", if a 1:2:4 mixture of concrete is used.
- The flat roof of a building covered with paper composition roofing is to be painted with one coat of Plastic Cement. If one gallon of this paint will cover 49 sq. ft. of surface, how many gallons must be purchased for a roof 20'-0" x 40'-0"?
- The corrugated metal roofing on a group of farm buildings is to be renailed and painted with red roofing paint. If each gallon of paint will cover 250 sq. ft. of surface, how many gallons must be purchased for 13708 sq. ft. of roof surface?
- The main roof on the barn contained 6,936 sq. ft. of roof surface, how many gallons of roofing paint should be charged to this job?

F. WEIGHTS

1. Sheet copper is ordered by size and weight per foot, but is sold only by the actual weight of the material. A carpenter ordered a sheet of copper weighing 16 ounces per sq. ft. The sheet was 16" x 42'-0". What was its total weight?
2. Find the weight of a sheet of 14 oz. copper that is 18" wide and 24'-0" in length.
3. A contractor purchased a ton of 8 d. common nails for \$177.50. What was the unit price per keg (100 lbs.)?
4. It requires 10 lbs. of 3 d. nails for each 100 square yards of 1 1/2" lath. How many kegs (100 lbs.) nails should you order for 2000 sq. yds. of 1 1/2" laths?
5. Figure the approximate weight of water in a tank whose dimensions are 2'-6" wide, 5'-6" long and 3'-9" deep, allowing 62 1/2 lbs. for each cubic foot of water.
6. A piece of sheet lead 8" wide, 6'-6" long is to be used for leading the joints on wood gutters. Find the weight of the sheet lead if it weighs 6 lbs. to the sq. ft.
7. In house framing 20 lbs. of 8 d. common wire nails are estimated for each 1000 Bd. Ft. (board feet) of sheathing or sub-flooring. How many kegs of nails would you order for 15,000 Bd. Ft. of sheathing?
8. Sand is estimated by the cubic yard but in certain localities it is sold by the ton. Find the weight of 5 cu. yds. of washed sand allowing 95 lbs. per cu. ft. of material.
9. What will 9 cu. yds. of washed gravel weigh if 105 lbs. per cu. ft. is allowed for the weight of the material?
10. When wood shingles are laid 4 1/2" to the weather an allowance of 5 3/4 lbs. of 4 d. nails is made for each square of shingles. How many lbs. of shingle nails must be ordered to lay 22 1/2 squares of shingles?
11. Find the cost of 15 cu. yds. of washed, and screened gravel, weighing 106 lbs. per cu. ft., at \$2.25 a ton.
12. What will be the cost of 8 cu. yds. of sand that have been washed and screened at \$2.15 a ton? Refer to Problem 8.
13. How many tons of washed gravel, weighing 105 lbs. per cu. ft. will a truck carry if the inside body measurements are 5'-6" wide, 14'-0" long and 2'-6" high and the material is levelled off to the top of the body?
14. Figure the number of tons of washed sand that a truck will hold if the body is 5'-0" wide, 12'-6" long and 2'-0" high. The load is level with the top of the body.

G. TEST NO. 1

1. Figure the cost of sanding a dining room floor which measures _____ wide and _____ long at _____¢ per sq. ft. of floor surface.
2. Ten pieces of sheetrock each measuring _____ in width and _____ in length were purchased at a cost of _____ a sq. ft. What was the total cost of the ten pieces?
3. A bathroom _____ wide and _____ long is to have the four sidewalls covered with metal lath to a height of _____. If an allowance of _____ sq. ft. is made for door and window openings, how many sq. yds. of wall surface would there be to cover?
4. The four sidewalls of a room _____ wide and _____ long are to be paneled to a height of _____. If deduction of _____ sq. ft. is made for door and window openings in the room, how many sq. ft. of wall surface are there to be covered?
5. What will be the cost of _____ pieces of sheetrock _____ wide and _____ long at a unit cost of _____¢ a sq. ft.?
6. _____ pieces of veneered plywood each measuring _____ wide and _____ long were used for the backs of cabinets. What was the actual number of sq. ft. of plywood used in the cabinets?
7. Figure the number of sq. ft. of surface in a concrete sidewalk _____ wide and _____ long.
8. How many cubic yards of concrete are necessary to pour eight footings _____ for lally columns?
9. If a board is _____" wide, _____" thick and _____ long, how many bd. ft. does it contain?
10. Find the number of bd. ft. in a joist _____.
11. What is the B. M. of _____ pieces of _____ studding _____ long?
12. The exterior walls of a building have _____ pieces of studding _____ long. How many bd. ft. of lumber are there in the studding?

G. TEST NO. 2

1. A contractor ordered a list of lumber in the following sizes. Figure the number of board feet of stock in the order:-

_____	pieces	2"	x	10"	x	14'-0"
_____	pieces	2"	x	10"	x	16'-0"
_____	pieces	2"	x	8"	x	14'-0"
_____	pieces	2"	x	8"	x	16'-0"
_____	pieces	2"	x	4"	x	18'-0"

NOTE:- THE QUANTITIES OF MATERIALS NECESSARY TO MAKE ONE CUBIC YARD OF CONCRETE FOR THE THREE MIXTURES OF CONCRETE MOST COMMONLY USED FOR ORDINARY WORK ARE GIVEN IN THE TABLE BELOW. THE VOIDS OR SPACES BETWEEN THE BROKEN STONE TAKE UP MOST OF THE SAND AND CEMENT AND THIS ACCOUNTS FOR THE SURPLUS OF MATERIAL OVER THE ACTUAL CONTENT OF A CUBIC YARD (27 CU. FT.)

Material Table

Mixture	Cement in bags.	Sand (Cu. ft.)	Crushed Stone (Cu. ft.)
1:2:4	6	12	24
1:2½:5	5	12½	25
1:3:6	4½	12½	25

2. Find the quantity of materials required for a concrete floor _____ in., if the concrete mixture is _____.
3. A concrete foundation wall that supports one side of a house is _____ long, _____ high and _____" thick. If a _____ mixture is used, what amounts of materials must be ordered?
4. When bank run gravel is used in concrete work, about _____ cubic yards of gravel are required to make one cubic yard of concrete. How many cubic yards of bank run gravel will be required for a concrete wall _____ long, _____ high and _____" thick?
5. Sand is estimated by the cubic yard but in certain localities it is sold by the ton. Find the weight of _____ cu. yds. of washed sand allowing _____ lbs. per cu. ft. of material.
6. What will be the cost of _____ cu. yds. of sand that have been washed and screened at \$ _____ a ton? Refer to Prob. 5.
7. Figure the number of tons of washed sand that a truck will hold if the body is _____ wide, _____ long and _____ high. The load is level with the top of the body.
8. How many tons of washed gravel, weighing _____ lbs. per cu. ft. will a truck carry if the inside body measurements are _____ wide, _____ long and _____ high and the material is levelled off to the top of the body?

BLOCK VI

RATIO

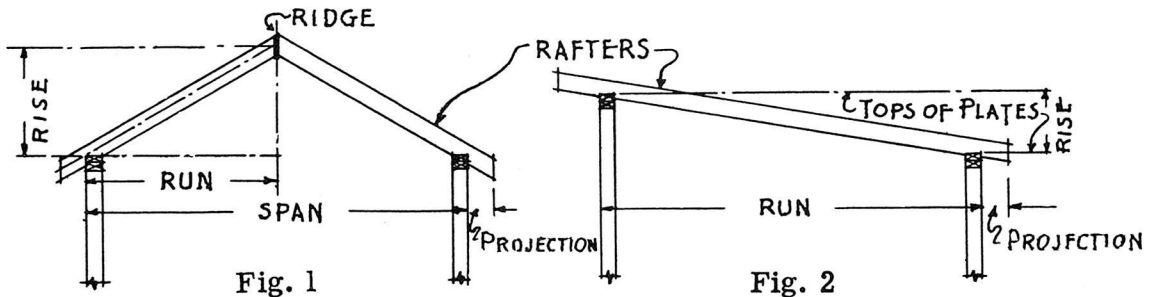
VI
1

A. RATIO

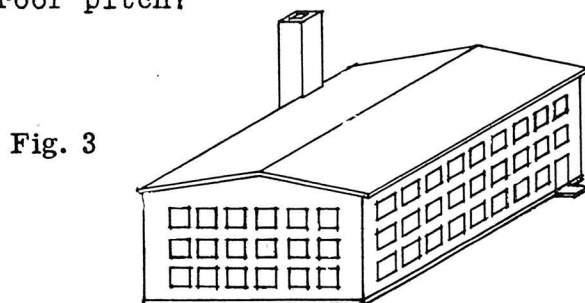
BLOCK VI - SHEET 1

NOTE:- THE PITCH OF A ROOF WHEN EXPRESSED AS A FRACTION IS THE RATIO OF THE RISE TO THE SPAN. IT IS EXPRESSED FRACTIONALLY AND REDUCED TO LOWEST TERMS.

FIGURES 1 AND 2 SHOW THE ROOF TERMINOLOGY NECESSARY FOR SOLVING OF THE FOLLOWING PROBLEMS:-



1. If in Figure 1, the rise were 8'-0" and the run of each rafter were 12'-0", what would be the pitch?
2. If, in Figure 1, the rise were 12'-0" and the run of each rafter were 12'-0", what would be the pitch?
3. In Figure 2, a shed roof is shown. If the roof run is 12'-0" and the rise is 3'-0", what is the roof pitch?
4. If a shed roof has a run of 16'-0" and a rise of 4'-0", what is the roof pitch?
5. A shed roof has a roof run of 8'-0" and a rise of 2'-0". What is the roof pitch?



6. The roof of the mill building, shown in Figure 3, has a rise of 5'-0" and a span of 60'-0". What is the pitch?
7. If the roof of the building, shown in Figure 3, has a rise of 3'-0" and a roof span of 72'-0", what would be the pitch?
8. What is the roof pitch of the building, Figure 3, if the span is 48'-0" and the rise 2'-0"?

A. RATIO

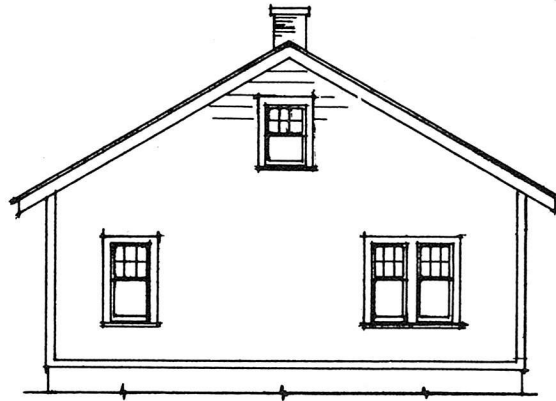
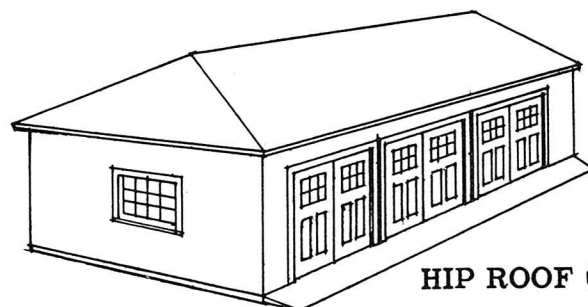


Fig. 1 GABLE ROOF HOUSE

1. Figure 1 shows a building with a gable roof. What is the roof pitch if the rise is 8'-0" and the span is 24'-0"?
2. What pitch will a gable roof have if the span is 28'-0" and the rise is 14'-0"?
3. What will the roof pitch be if the span is 24'-0" and the rise is 10'-0"?
4. If the run of the gable roof in Figure 1, is 13'-6" and the rise is 9'-0", what is the roof pitch?
5. A gable roof has a run of 15'-0" and a rise of 10'-0"; what is the pitch?
6. The roof of a mill building has a run of 24'-0" and a rise of 2'-0"; what is the pitch?
7. Figure 2 shows a garage having a hip roof. What will be the roof pitch if the run is 12'-0" and the rise is 8'-0"?

Fig. 2



HIP ROOF GARAGE

8. What would the roof pitch be for a hip roof if the span is 24'-0" and the rise is 6'-0"?

B. TEST

1. If the rise of a roof were _____ and the run of each rafter were _____, what would be the pitch?
2. If the rise of a roof were _____ and its run was also _____ feet, find the pitch.
3. A shed roof has a run of _____ feet and a rise of _____ feet. What is the pitch?
4. The roof of a mill building has a rise of _____ and a span of _____. What is the pitch?
5. If the roof of a building has a rise of _____ and a roof span of _____, what would be the pitch?
6. What is the roof pitch of a school building if the span is _____ and the rise _____?
7. What will be the roof pitch of a garage having a hip roof if the run is _____ and the rise is _____?
8. What would the roof pitch be for a hip roof if the span is _____ and the rise is _____?
9. If the run of a gable roof is _____ and the rise is _____, what is the roof pitch?
10. A gable roof has a run of _____ and a rise of _____; what is the pitch?

BLOCK VII

POWERS AND ROOTS

A. ABSTRACT PROBLEMS

BLOCK VII - SHEET 1

IN THE EXPRESSION 3^2 , THE SMALL FIGURE ² IS CALLED THE EXPONENT AND IS A POWER THAT INDICATES HOW MANY TIMES THE FIGURE 3 IS TO BE TAKEN AS A FACTOR. IN THIS CASE TWICE OR 3×3 .

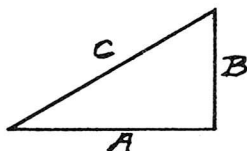
Solve the following expressions as explained above:-

- | | | | | |
|----------|-----------|-----------|-----------|------------|
| 1. 7^2 | 3. 9^2 | 5. 11^2 | 7. 25^2 | 9. 35^2 |
| 2. 8^2 | 4. 10^2 | 6. 15^2 | 8. 30^2 | 10. 50^2 |

In the expression $\sqrt{144}$, the radical sign ($\sqrt{\quad}$) is a square root sign. When the radical sign is placed over a number as ($\sqrt{144}$) it asks what number multiplied by itself will produce the number under the radical sign. In this case 12 is the number desired.

Solve the following expressions and carry the result out to two decimal places.

- | | | | | |
|------------------|------------------|------------------|-------------------|-------------------|
| 11. $\sqrt{81}$ | 13. $\sqrt{169}$ | 15. $\sqrt{529}$ | 17. $\sqrt{892}$ | 19. $\sqrt{1692}$ |
| 12. $\sqrt{100}$ | 14. $\sqrt{361}$ | 16. $\sqrt{743}$ | 18. $\sqrt{1235}$ | 20. $\sqrt{2000}$ |



POWERS AND ROOTS ARE USED TO ADVANTAGE IN SOLVING RIGHT TRIANGLES. RULE: The square of the hypotenuse = the sum of the squares of the other two sides.

In the right triangle A B C, shown above, C is the hypotenuse and A and B are the other two sides.

Then from the rule (1) $C^2 = A^2 + B^2$

And it follows that (2) $B^2 = C^2 - A^2$

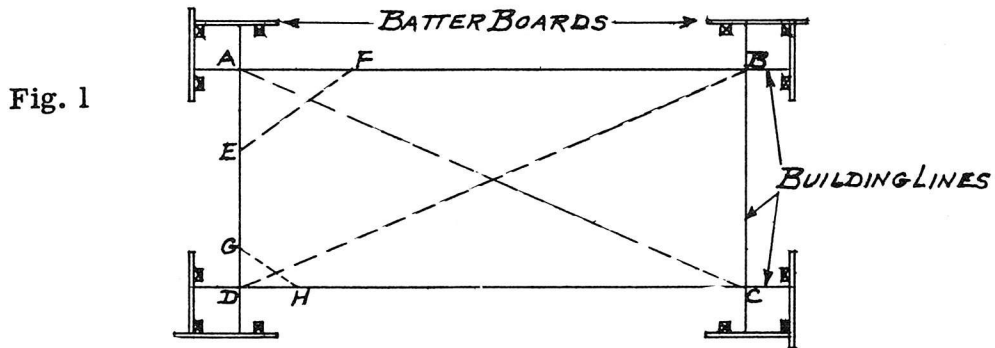
And (3) $A^2 = C^2 - B^2$

BY SUBSTITUTION IN THE ABOVE FORMULAS, SOLVE THE FOLLOWING:-

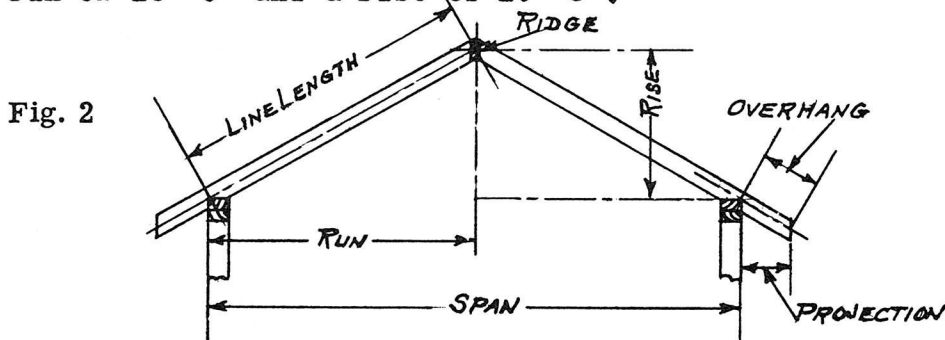
- | | |
|---------------------------------|---------------------------------|
| 21. Find C if A = 9 and B = 10 | 24. Find A if C = 12 and B = 8 |
| 22. Find C if A = 11 and B = 13 | 25. Find B if C = 27 and A = 13 |
| 23. Find A if C = 7 and B = 5 | 26. Find B if C = 33 and A = 18 |

B. PRACTICAL PROBLEMS

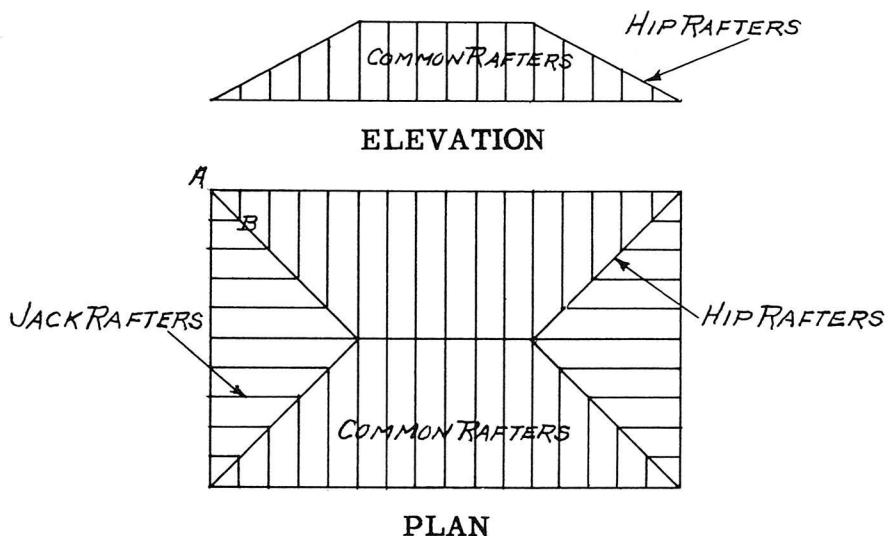
1. In Figure 1, the rectangle A B C D represents the lines of excavation for the foundation of a house. If the line AB is 45'-0" and AD is 27'-0", how long should the two diagonals AC and BD be?



2. Figure the lengths of the diagonals AC and BD in Figure 1, if the side AB is 43'-6" and AD is 32'-6".
3. In checking the corner D, in Figure 1, to find out if it is square, GD is laid off equal to 3'-0" and DH is laid off equal to 4'-0". What should the length of the line GH be?
4. What would be the length of the diagonals AC and BD, in Figure 1 if the lines AB and BC are 41'-6" each?
5. To square up the corner A, in Figure 1, we lay off AE equal to 6'-0" and AF equal to 8'-0". What length should we then make the line EF?
6. What is the line length of the rafter, in Figure 2, if the run is 12'-0" and the rise is 8'-0"?
7. A common gable roof, similar to the one shown in Figure 2, has a span of 36'-0" and a rise of 9'-0". What is the line length of the common rafter?
8. Figure the common rafter line length for a roof that has a run of 16'-0" and a rise of 10'-8".



B. PRACTICAL PROBLEMS



The above diagram is a framing plan of a hip roof. It will be noted that the run of a common rafter is related to that of a hip rafter as the sides of a square to the hypotenuse.

1. What is the run of the hip rafter shown in the above diagram, if the run of the common rafter is 14'-0"?
2. What is the unit of run (A-B) on the hip rafter, as shown above, if the unit run on the common rafter is 12"?
3. Compute the run of the hip rafter, if the common rafter run is 15'-0".
4. If a house has a common rafter run of 10'-0" and a rise of 5'-0", what is the line length of the hip rafter used?

Note:- After the run of the hip rafter is found, the line length is found in the same manner as the line length of a common rafter.

5. What is the line length of the hip rafter of a roof if the common rafter run is 12'-0" and the rise is 6'-0"?
6. If a hip roof has a common rafter run of 13'-6" and a pitch of $\frac{1}{3}$, what are the line lengths of the common rafter and the hip rafter?
7. In a hip roof of $\frac{1}{4}$ pitch, the span is 40'-0". Find the line lengths of the common rafters and the hip rafters.
8. Figure the line length of a hip rafter for a roof, the common rafter of which has a line length of 16'-0". The rise of the roof is 8'-0".

C. TEST

1. A garage foundation measures _____ by _____. What should the diagonals measure on this foundation when the building is staked out properly?

2. A septic tank measuring _____ by _____ is to be laid out. What should the diagonals measure in checking the forms for squareness?

3. What is the line length of a rafter if the rise is _____ and the run is _____?

4. What would be the line length of a rafter where the rise is _____ and the run is _____?

5. What is the run of a hip rafter if the run of the common rafter for the same roof is _____?

6. If a house has a common rafter run of _____ and a rise of _____ what is the line length of the hip rafter?

BLOCK VIII

MENSURATION

A. AREA CALCULATIONS-RECTANGLES

BLOCK VIII - SHEET 1

1. Find the surface area of both sides of the gable roof shown in Figure 1.

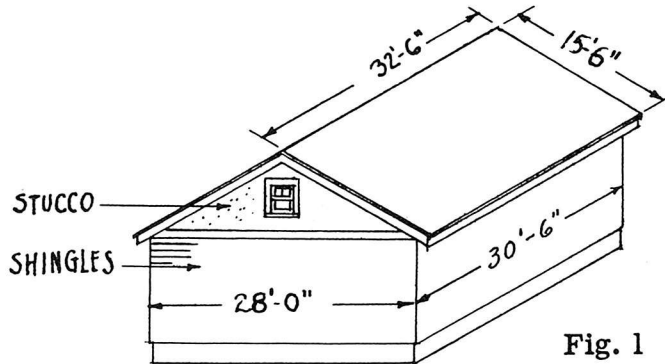


Fig. 1

2. If the walls are to be covered with shingles to a height of 11'-9", in Figure 1, what area is to be covered by these shingles if window and door openings are disregarded?
3. A storage house is 54'-0" x 32'-0" outside and the walls are 22'-6" high. How many square feet of outside wall surface must be covered by building paper if the only opening is 8'-6" x 8'-6"?
4. How many square feet of $\frac{7}{8}$ " stock will be required for forms for fourteen 8" x 8" x 13'-6" columns?
5. How many square feet of form work must be constructed for the two exterior sides A and B, of the concrete culvert, Figure 2.

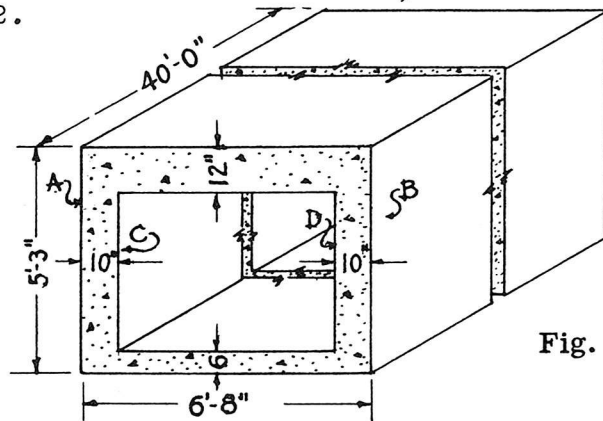


Fig. 2

6. How many sq. ft. of form work will be required for the interior sides C and D of the culvert shown in Figure 2?
7. Figure the surface area of form work required for the interior top and bottom concrete walls shown in Figure 2.

A. AREA CALCULATIONS - RECTANGLES

1. How many sq. ft. must be covered with cedar lining in a chest that is 4'-6" long x 2'-0" wide x 1'-9" high, inside measurement? Figure on covering the top, bottom, and sides.
2. Figure the number of square yards of wall and ceiling surface in a room 17'-6" x 25'-6" x 9'-0" high. Deduct for one door opening 2'-6" x 6'-8" and two window openings each 2'-2" x 5'-2".
3. How many sq. ft. of form work will be required for the foundation walls of a house if the outside dimensions are 32'-0" x 24'-0" x 4'-6" high? The wall is 10" thick.
4. Figure the number of sq. ft. of form work for the ends and openings of the concrete wall shown in Figure 4.

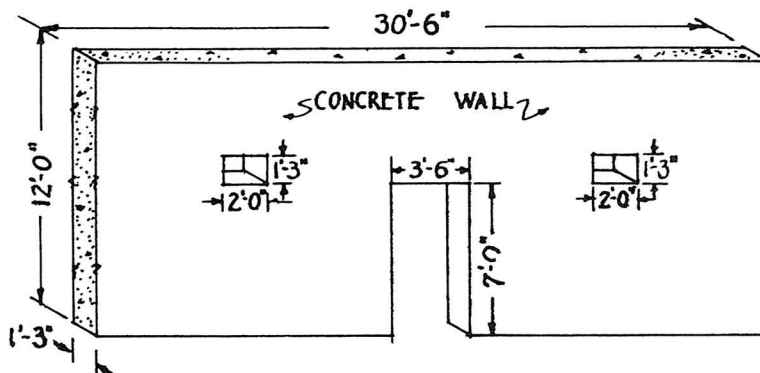


Fig. 4

5. Both sides of the concrete wall in Figure 4 are to be covered with lattice work. Compute the surface area to be covered, if a deduction for all openings is made.
6. The walls and ceiling in a room 21'-6" x 15'-6" x 8'-6" high are to be lathed. How many sq. yards of lathing will be required to do the job, deducting for two doors each 2'-6" x 6'-9" and two windows each 2'-0" x 5'-2"?
7. Figure the outside area of an exterior wall that is to be covered with building paper if the house is 36'-6" x 20'-6" x 10'-3". Make no allowance for openings.
8. How many square feet of form work would be required for the entire wall in Figure 4?

B. AREA CALCULATIONS - TRIANGLES

1. How many square feet are there in the gable end shown in Figure 1?

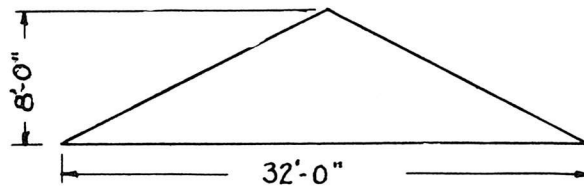


Fig. 1

2. If the gable was 50'-0" wide with a rise of 10'-0", what would be the area in square feet?
3. A gable end, similar to the one shown in Figure 1, has a 7'-6" rise and span of 30'-6". What is its area?
4. How many square feet must be covered to box in one side of the ramp as shown in Figure 2?

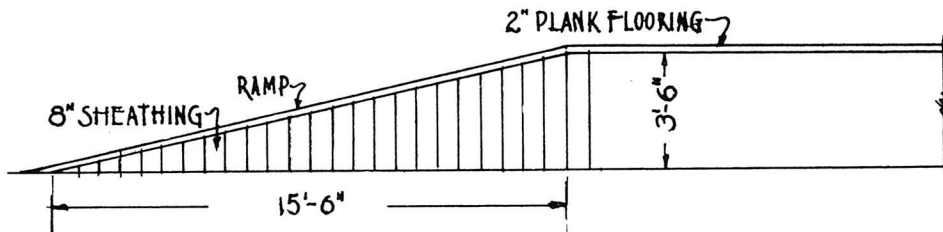
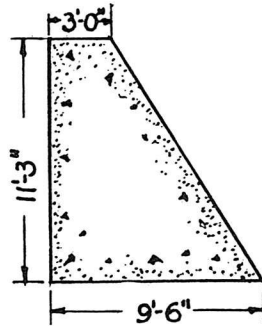


Fig. 2

5. What is the area of a square hip roof in the shape of a pyramid if the length of one side is 12'-0" and the common rafter length is 14'-6"? No allowance for overhang.
6. What is the roof area of a hip roof on a building that is 36'-0" long and 24'-0" wide? The common rafter length is 17'-0". Make no allowance for overhang.

B. AREA CALCULATIONS - TRIANGLES

Fig. 3



1. Figure the number of square feet of form work required for the end of the concrete retaining wall shown in Figure 3.
2. What is the area of the portion marked "A" of the gambrel gable shown in Figure 4?

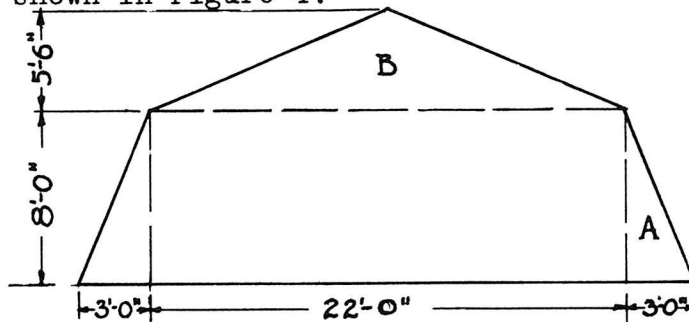
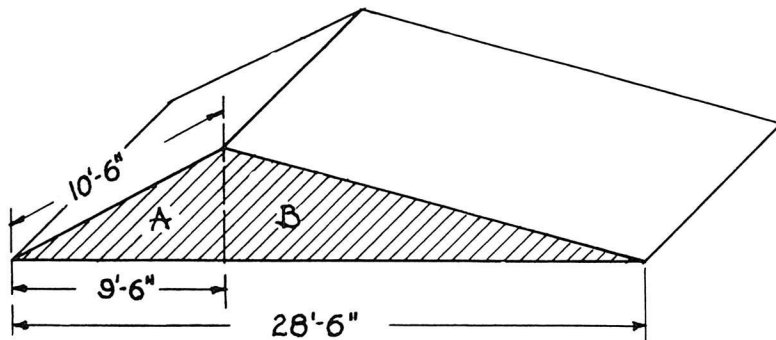


Fig. 4

3. Figure the area of portion "B" in Figure 4.
4. How many square feet would be covered with siding in the whole gable end shown in Figure 4? No allowance for cornice.
5. An unequally pitched roof has a shape similar to the sketch in Figure 5. What is the area of surface "A"?
6. What is the area of surface "B", in Figure 5?

Fig. 5



B. AREA CALCULATIONS - TRIANGLES

1. A common gable roof has a span equal to 28'-6" and the length of the common rafters is 19'-6". How many square feet of surface are there in one of the gable ends?
2. What is the area of the common gable ends of a house with a span of 33'-0" and a $1/3$ pitch?
3. What is the area of the square hip roof shown in Figure 6?

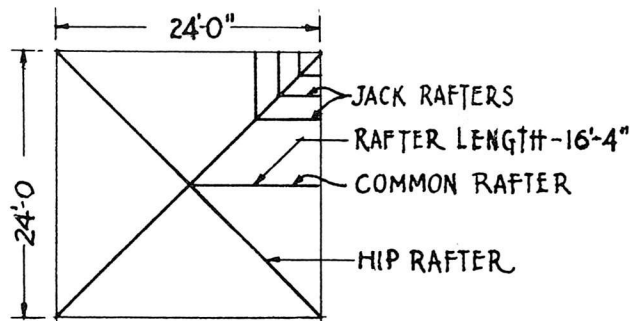


Fig. 6

4. Figure the area of the shaded portions of the hip roof that is in Figure 7 if the length of the common rafter is 7'-2 1/2".

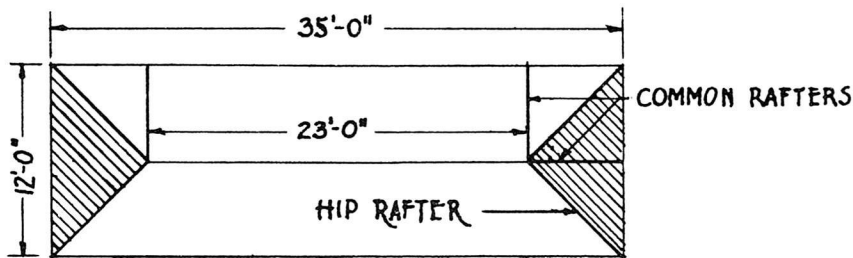


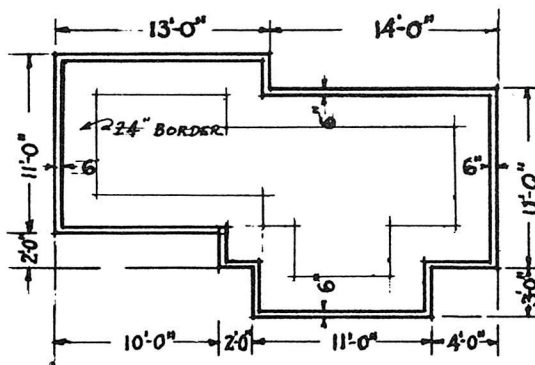
Fig. 7

5. What is the area of the entire roof surface shown in Figure 7?
6. A building lot is in the shape of an isosceles triangle with base of 80'-0" and altitude of 50'-0". What is the area in square feet?
7. A triangular table top measures 4'-0" along each side and the altitude of the triangle is 2'-6". Compute the area.

C. AREA CALCULATIONS - IRREGULAR FIGURES

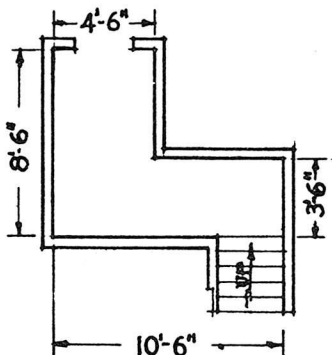
1. How many square feet of floor surface are there inside the walls in the plan shown in Figure 1?

Fig. 1



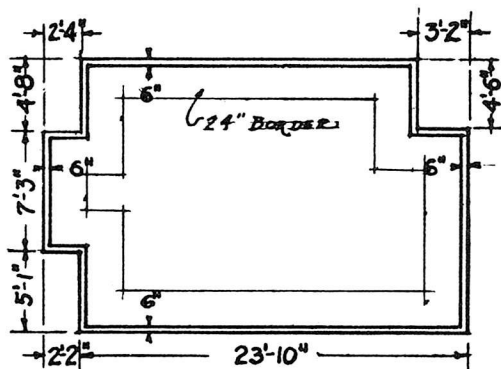
2. Find the area of the hallway shown in Figure 2.

Fig. 2



3. Figure the floor area included within the walls in the plan shown in Figure 3.

Fig. 3



C. AREA CALCULATIONS - IRREGULAR FIGURES

1. The floor surface shown in Figure 1, Page 6, is to have a border of oak 24" wide laid around the entire floor. How much area will this border cover?
2. Figure the area of a 24" border of hard wood around the floor shown in Figure 3, Page 6.
3. How many square feet of floor surface are there in room "A", Figure 4?
4. Figure the floor area to be covered in the room "B" shown in Figure 4.

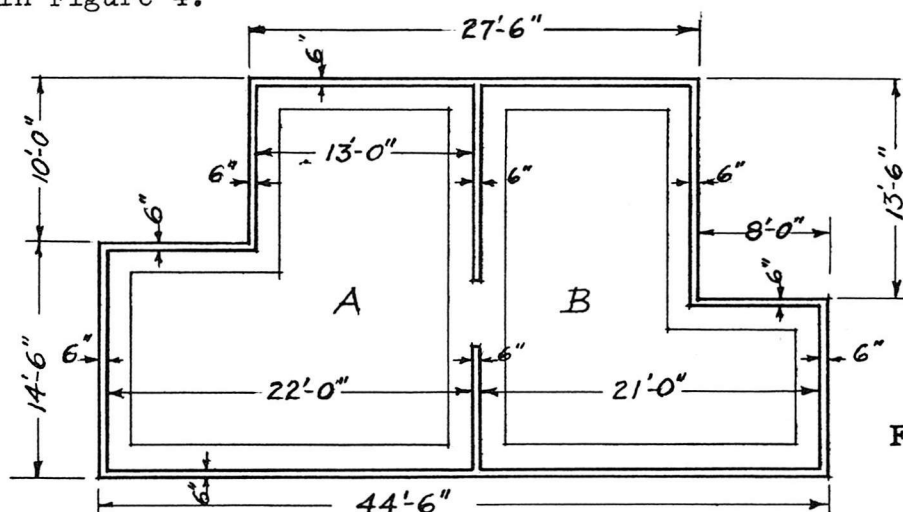
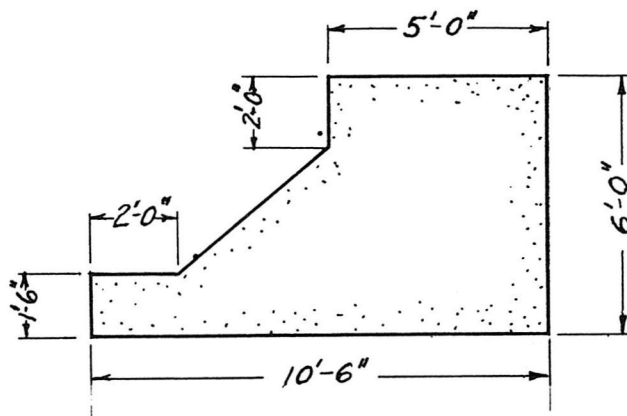


Fig. 4

5. How many square feet of border surface are there in both rooms, if the border is to be 16" wide?
6. How many square feet of surface are there in the end of the retaining wall in Figure 5?

Fig. 5



C. AREA CALCULATIONS - IRREGULAR FIGURES

1. How many sq. ft. of form work will it take for the outside finished face, from top to bottom, of the retaining wall shown in Figure 6, if the wall is 40'-0" long?

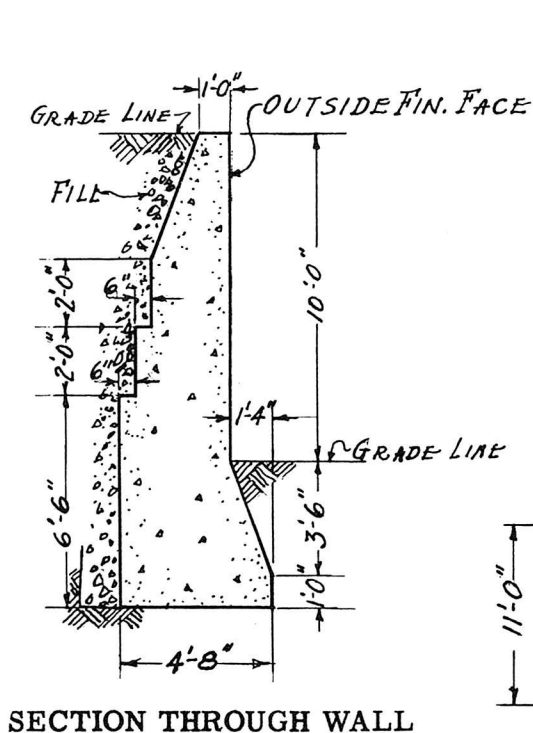


Fig. 6

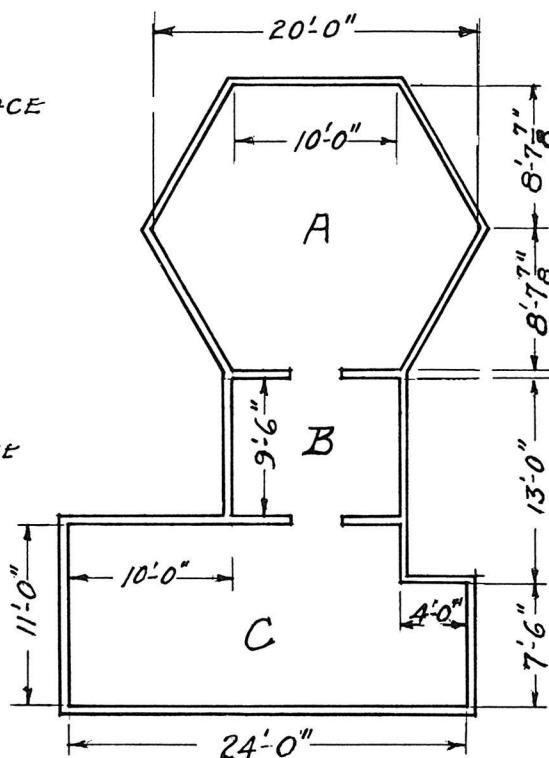


Fig. 7

2. Figure the area of the end of the retaining wall above the lower grade in Figure 6.
3. If form work is required for the top of the 6" steps, in Figure 6, how many square feet of form work will it take for the fill side of the retaining wall if it is 40'-0" long?
4. What is the area of the end of the retaining wall below the lower grade in Figure 6?
5. In the room "A" shown in Figure 7, how many square yards of laths will it take to lath ceiling?
6. How many square yards of lathing will it take to lath the ceilings "B" and "C" in Figure 7?
7. If the walls in Figure 7 are 8'-6" high, how many square yards of lathing are called for if the openings total 112 sq. ft.?

D. AREA CALCULATIONS - CIRCLES

1. How many square feet of ground area are occupied by a circular band stand that has a diameter of 20'-0"?
2. Figure the surface to be floored in a semi-circular bay window, as shown in Figure 1, if the radius is 3'-6".

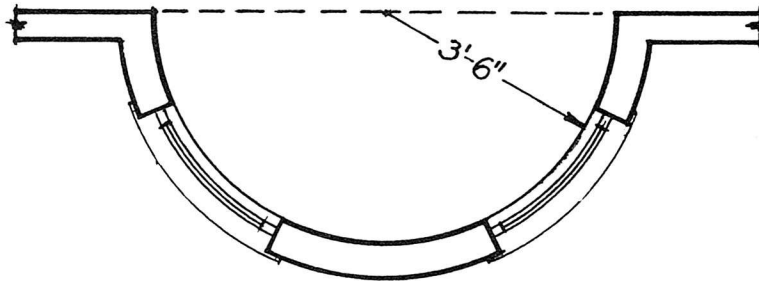


Fig. 1

3. Figure the number of square yards to be lathed in a circular ceiling that has a diameter of 9'-3".
4. How many square feet of floor area are included in the shaded portion of the gymnasium floor in Figure 2?

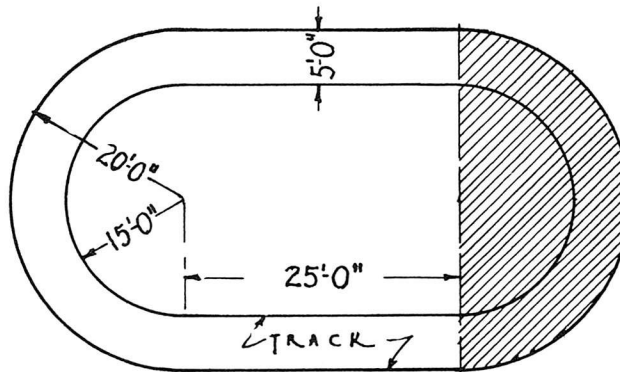
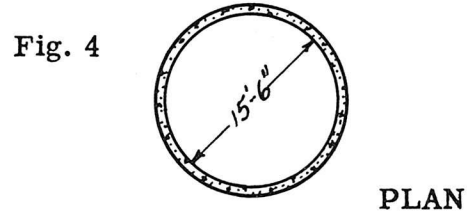
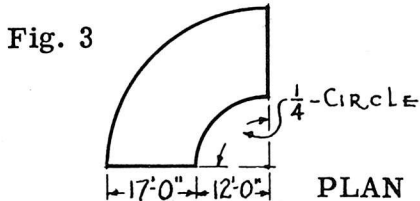


Fig. 2 - GYM FLOOR PLAN

5. Figure the surface area of the gymnasium floor inside the track lane as shown in Figure 2.
6. In Figure 2, the width of the track lane is 5'-0". How many square feet of floor surface are there in the entire track lane?

D. AREA CALCULATIONS - CIRCLES

1. How many square feet of ground area would be occupied by the curved run-way shown in Figure 3?



2. Find the number of square yards of surface area to be lathed in the ceiling of a semi-circular bay window that has a radius of 12'-6".
3. How many square feet of concrete surface will there be in the bottom of the silo in Figure 4?

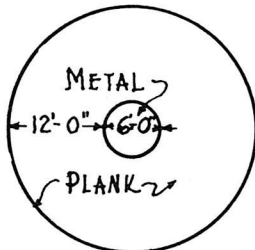


Fig. 5

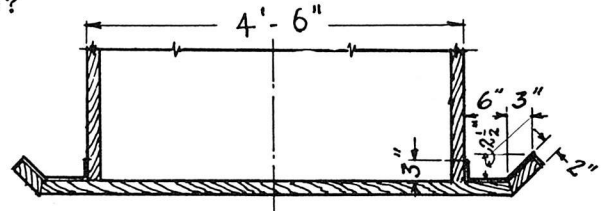
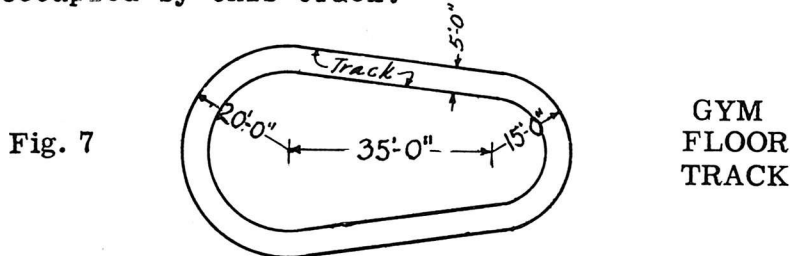


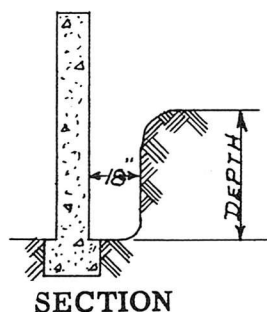
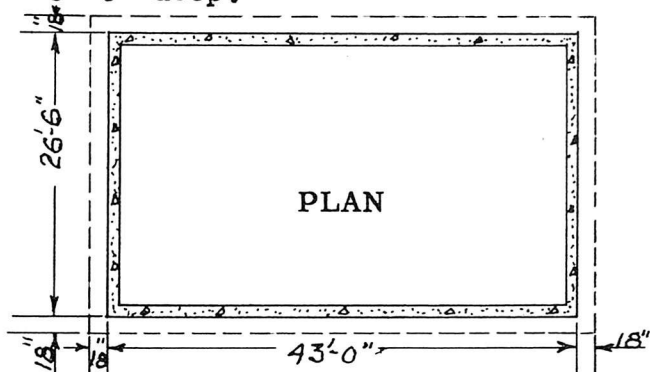
Fig. 6

4. A turn table in a garage, see Figure 5, is to be made of planking with a sheet metal center. How many square feet of surface will be covered by planks?
5. How many square yards of lathing will be required for a bay window ceiling if the bay is one quarter of a circle in plan and has a radius of 7'-6"?
6. An inside water tank, circular in plan, has a copper lined gutter at the bottom around the outside. See section, Figure 6. How many square feet of surface must be covered with copper?
7. It is desired to lay a rough floor under the space occupied by the track in the gymnasium shown below. Determine the area occupied by this track.

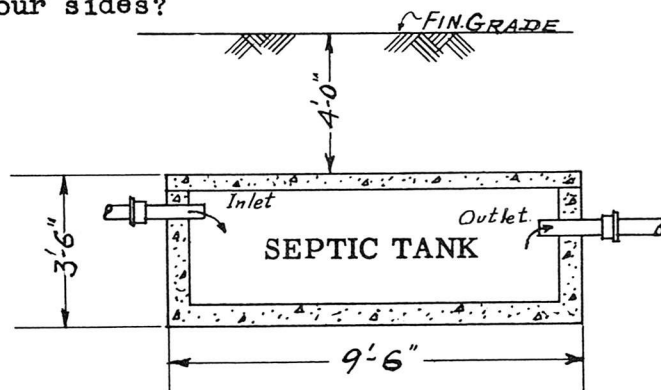


E. VOLUME CALCULATIONS - RECTANGULAR SOLIDS

1. How many cubic yards of earth were removed from a cellar excavation that is 33'-0" x 25'-0" x 4'-0" deep?
2. The excavation for a cellar is 39'-6" x 24'-6" x 4'-6" deep. How many cubic yards of earth were removed?
3. Figure the cubic yards of excavation for the cellar shown below, making no allowance for form work. The excavation is 3'-9" deep.

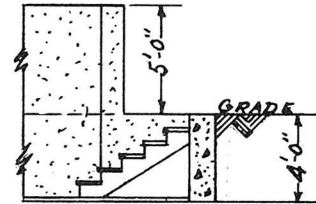
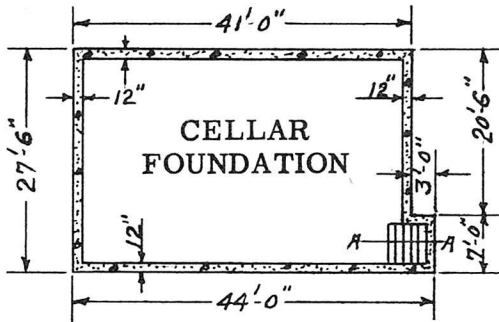


4. How many cubic yards of earth will have to be removed for the cellar shown above if an 18" clearance is made for form work and the excavation is 4'-0" deep?
5. A concrete trench wall is 18" thick and 27'-6" long. If the wall extends 2'-6" below the surface of the ground, how many cubic yards of earth must be removed to place this foundation? The nature of the soil is such that no form work is required.
6. If the septic tank, shown below, is 4'-0" wide, how many cubic yards of earth must be removed to place it in the position shown? Allow 1'-0" on all sides for clearance.
7. The septic tank, shown below, is to be "cast in place" of concrete and is to be 5'-6" wide. How many cubic yards of earth must be removed if an 18" space for form work is to be allowed on all four sides?



E. VOLUME CALCULATIONS - RECTANGULAR SOLIDS

- Figure the cubic yards of excavation that must be removed for the cellar shown below. Omit the stepped section but allow 18" all around for form work. Assume the grade to be level.



SECTION THRU A-A

- Figure the cubic yards of excavation that must be removed for the same cellar if no allowance is made for form work clearance. Include the excavation for the steps.
- How many cubic feet capacity would there be in a wooden dye-vat that measured 37'-6" x 21'-0" x 5'-0" inside?
- A vat, similar to the one in Problem 3, is to be built with the same capacity, but having a height of 3'-6" and width of 25'-0". What should the length be?
- What will be the capacity in cubic feet of the dye-vat shown below, Figure 1?

Fig. 1

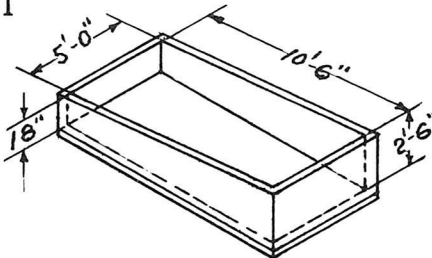
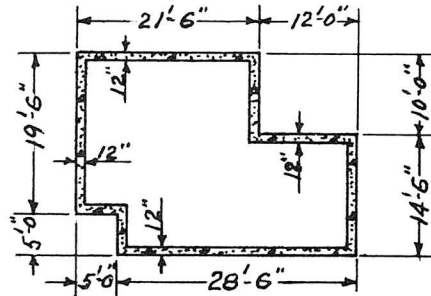
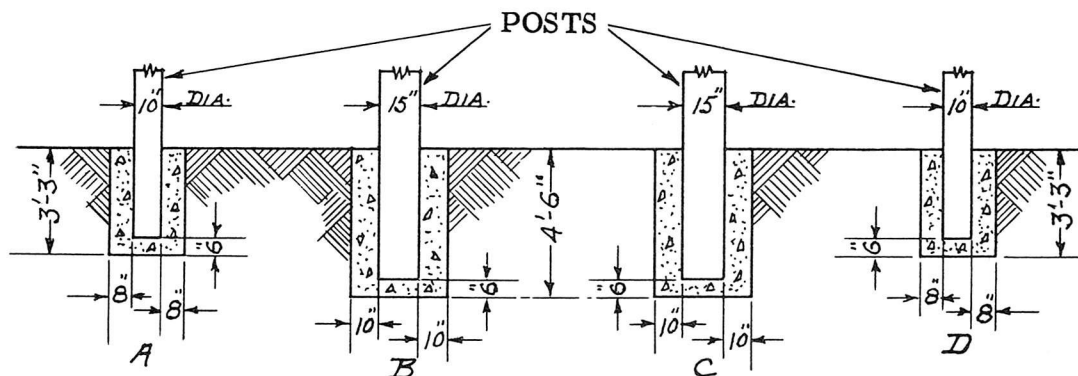


Fig. 2



- How many cubic yards of earth must be removed to set a concrete septic tank that measures 14'-0" x 8'-6" x 4'-6"? The top of the tank is 3'-0" below the grade and an allowance of 18" must be made all around to erect the form work.
- A carpenter is required to build a rectangular wooden tank to hold 2,250 gallons. If the inside length and width must measure 10'-0" x 6'-0" respectively, how high must it be?
- How many cubic yards of earth must be excavated for the cellar shown above, Figure 2, if the bottom is 3'-6" below the ground surface? An allowance of 18" must be made all around for form work.

F. VOLUME CALCULATIONS - CYLINDERS



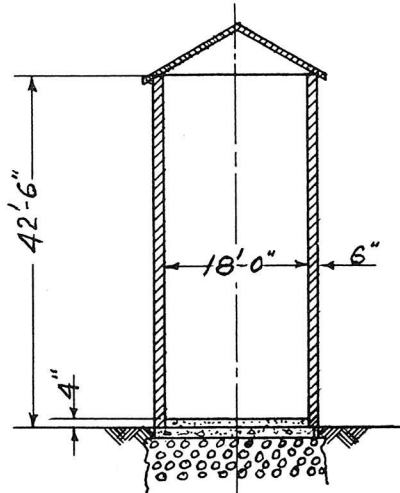
FOUNDATION FOR BILLBOARD

NOTE: All footings and posts are circular in plan.

1. What is the total number of cubic feet of earth that must be removed for the circular footings A and D above?
2. How many cubic feet of concrete will be necessary to pour the footings A and D?
3. The two footings B and C are alike. How many cubic yards of earth must be excavated for both of these footings?
4. In the footing B, how many cubic feet of concrete will it take?
5. Find the exact number of cubic yards of concrete it will take for the footings shown above, if posts A and D are changed to 8" in diameter and B and C are changed to 12" diameter. All other dimensions remain unchanged.
6. How many cubic yards of concrete will it take for a silo base that is 14'-6" in diameter and 2'-6" deep?
7. A contractor has to figure the rock fill for four circular dry wells. If two of these wells are 4'-0" in diameter and 4'-6" deep and the remaining two are 3'-6" in diameter and 5'-0" deep, how many cubic yards of fill will be required for the wells?
8. Figure the square feet of wall surface on the inside of a wooden silo that has a capacity of 3392.7 cubic feet and a height of 30'-0".

F. VOLUME CALCULATIONS - CYLINDERS

1. What is the capacity, in cubic feet, of the silo shown below?



2. If the wall of this silo is built of concrete, how many cubic yards will it take to do the job?
3. How many cubic yards of earth must be excavated for a concrete cistern that has an outside diameter of 9'-6" and is 10'-0" deep? An allowance of 18" must be made around walls for form work. Top of cistern is 4'-0" below grade.
4. A contractor must figure the excavation and rock fill for two circular dry wells. How many cubic yards of rock fill will it take if one well has a diameter of 5'-0" and a depth of 6'-6" and the other has a diameter of 5'-6" and a depth of 7'-0"?
5. Figure the cubic yards of concrete necessary for a concrete silo base having a diameter of 17'-6" and a depth of 8".
6. What would the capacity be, in gallons, of a wooden storage tank that has an inside diameter of 16'-0" and inside height of 18'-9"?
7. A porch roof is to be supported by two (2) solid concrete pillars. The pillars are 2'-0" in diameter and 10'-0" high. How many cubic feet of concrete will the two pillars contain?
8. Pieces of wrought-iron pipe, 4" in diameter inside, are to be filled with concrete and used for posts to support the main floor girder in the cellar of a residence. If these posts must be 8'-0" long and there are six (6) in all, how much concrete will be required for the job?

G. TEST NO. 1

1. How many square feet of form work will be required for the foundation walls of a house if the outside dimensions are _____? The wall is _____" thick.
2. A storage house is _____ outside and the walls are _____ high. How many square feet of outside wall surface must be covered by building paper if the only opening is _____?
3. How many square feet of _____" stock will be required for forms for fourteen _____ columns?
4. Figure the number of square yards of wall and ceiling surface in a room _____ long, _____ wide, _____ high. Deduct for one door opening _____ and two window openings each _____
5. The walls and ceiling in a room _____ long, _____ wide, _____ high are to be lathed. How many square yards of lathing will be required to do the job, deducting for two doors each _____ and two windows each _____?
6. A house is _____ long, _____ wide and its walls average _____ high. What is the net area of outside wall surface if _____ sq. ft. is deducted for openings?
7. If a gable were _____ wide with a rise of _____, what would be the area in square feet?
8. What is the area of a square hip roof in the shape of a pyramid if the length of one side is _____ and the common rafter length is _____. Make no allowance for overhang.
9. What is the roof area of a hip roof on a building that is _____ long and _____ wide? The common rafter length is _____. Make no allowance for overhang.
10. A common gable roof has a span of _____ and the length of the common rafters is _____. What is the area of the gable ends?
11. What is the area of the common gable ends of a house, the roof of which has a span of _____ and a pitch of _____?
12. A building lot is in the shape of an isosceles triangle with a base of _____ and an altitude of _____. What is the area in square feet?
13. A triangular table top measures _____ on one side and the altitude of the triangle is _____. Compute the area.

G. TEST NO. 2

1. How many square feet of ground area are occupied by a circular band stand that has a diameter of _____?
2. Figure the surface to be floored in a semi-circular bay window if the radius is _____.
3. Figure the number of square yards to be lathed in a circular ceiling that has a diameter of _____.
4. Find the number of square yards of surface area to be lathed in the ceiling if the bay is one-quarter of a circle in plan and has a radius of _____.
5. How many square yards of lathing will be required for a bay window ceiling if the bay is one-quarter of a circle in plan and has a radius of _____?
6. How many cubic yards of earth were removed from a cellar excavation that is _____ long, _____ wide, _____ deep?
7. The excavation for a cellar is _____ long, _____ wide, _____ deep. How many cubic yards of earth were removed?
8. A concrete trench wall is _____" thick and _____ long. If the wall extends _____ below the surface of the ground, how many cubic yards of earth must be removed to place this foundation? The nature of the soil is such that no form work is required.
9. How many cubic feet capacity would there be in a wooden dye vat which measures _____ inside?
10. A carpenter is required to build a rectangular wooden tank to hold _____ gallons. If the inside length and width must measure _____ and _____ respectively, how high must it be?
11. A contractor has to figure the rock fill for four circular dry wells. If two of these are _____ in diameter and _____ deep and the remaining wells are _____ in diameter and _____ deep, how many cubic yards of fill will be required for the wells?
12. Figure the square feet of wall surface on the inside of a wooden silo that has a capacity of _____ cubic feet and a height of _____. The silo is circular in plan with uniform diameter.
13. Figure the cubic yards of concrete necessary for a concrete silo base having a diameter of _____ and a depth of _____.
14. A porch roof is to be supported by two (2) solid concrete pillars. The pillars are _____ in diameter and _____ high. How many cubic feet of concrete will the two pillars contain?

BLOCK IX-S

TAKING OFF QUANTITIES

A. GIRDERS

BLOCK IX-S - SHEET 1

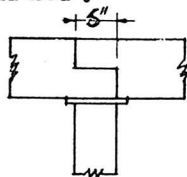
EXPLANATION

In house construction, the large beams under the first floor, which carry the ends of the floor joists, where no wall occurs, are called "girders". These girders are usually supported at their ends by the outside foundation walls and between the walls by posts or masonry piers spaced at intervals depending on the ability of the beam to support the superimposed load.

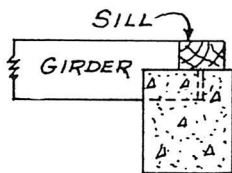
The size of the girders and the spacing of the posts is calculated by the Architect and shown on the working drawing of the basement or cellar.

Girder stock can only be purchased in multiples of 2 ft. in length up to 40'-0" but to avoid added cost girders should not be listed longer than 16'-0". All joints must be made over columns, piers, or posts, the spacing of which will determine the lengths in which the girders should be ordered.

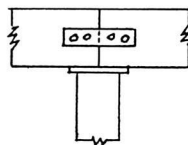
In listing solid girders make allowance for the joints and bearing as shown in the sketches. There are no lap joints in a built-up girder and the size is the same as for a solid girder.



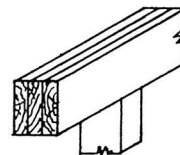
SOLID GIRDER
LAP JOINT



SILL FRAMED
INTO GIRDER



SOLID GIRDER
BUTTED TOGETHER



BUILT UP
GIRDER

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST THE REQUIRED SIZE AND LENGTHS OF GIRDERS, AND CALCULATE THE BOARD FEET REQUIRED, IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

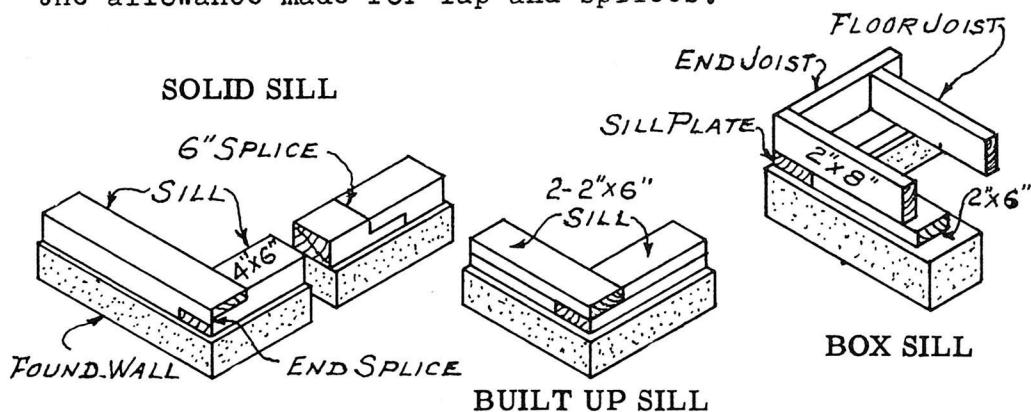
1. The solid girder under the partition between the living room and dining room. List for both lap and butt joints.
2. The solid girder running from the front to the back of the house. List for both lap and butt joints.
3. The solid girder under the partition between the entry and kitchen.
4. A built-up girder under the partition between the living and dining room.
5. A built-up girder under the partition from the front to the back of the house.
6. A built-up girder under the partition between the entry and kitchen.

B. SILLS

EXPLANATION

A foundation sill rests on the top of the foundation wall, usually 1" in from the outside face of wall. Sill stock should not be ordered longer than 26'-0" to avoid extra charge and possibility of twisting. It is sold in multiples of 2 feet.

Observe the sketches below in taking off the various sills called for in the following problems. Note also the allowance made for lap and splices.



USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST THE SIZES AND LENGTHS, AND CALCULATE THE BOARD FEET OF SILLS IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. The solid sill running along the front foundation wall.
2. The solid sill along the left wall.
3. The solid sill along the 32 foot foundation wall.
4. The solid sill along the rear foundation wall.
5. Figure Problem 1 using a built-up sill.
6. Figure Problem 2 using a built-up sill.
7. Figure Problem 3 using a built-up sill.
8. Figure Problem 4 using a built-up sill.
9. Figure Problem 1 using a box sill.
10. Figure Problem 2 using a box sill.
11. Figure Problem 3 using a box sill.
12. Figure Problem 4 using a box sill.

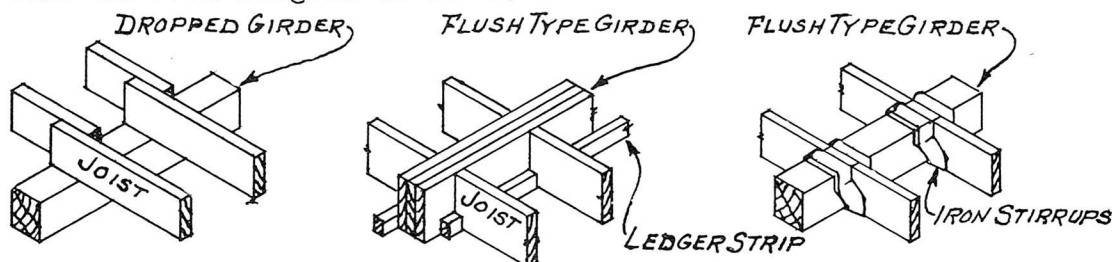
C. FLOOR JOISTS

EXPLANATION

Usually the size, spacing, and direction of the first floor joists of a building will be found on the Basement Plan, of the second floor joist on the First Floor Plan, and of the attic floor joists on the Second Floor Plan.

Floor joists run at right angles to the girder or wall which carries them, and for purposes of listing may be considered to extend to the outside face of the sills.

The usual lengths of joist stock run from 8 to 24 feet and come in even lengths of feet.

JOISTS LAPPED
ON SOLID GIRDERBUILT UP
GIRDERJOISTS HANG
ON SOLID GIRDER

Distance C. to C. of Joists	12"	14"	16"	18"	20"	22"	24"
Factor for Determining Number of Joists	1	6/7	3/4	2/3	3/5	6/11	1/2

The above table may be used to determine the number of joists for a given area when the spacing is given. By measuring, obtain the dimension, in feet, of the area at right angles to the direction of the joist and multiply by the factor opposite the proper joist spacing. To the product, add (1) for a starter.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST THE SIZE AND LENGTH, AND CALCULATE THE BOARD FEET OF FLOOR JOISTS IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

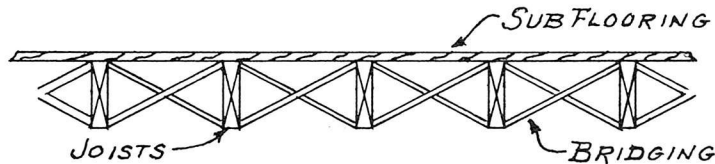
1. Living room floor, using drop girder construction.
2. Living room floor, using flush type girder construction.
3. Dining room and kitchen floors using drop girder construction.
4. Dining room and kitchen floors using flush girder construction.
5. Entry floor using drop girder construction.
6. Entry floor using flush girder construction.
7. Both chambers and the bathroom floors using drop girder construction.
8. Both chambers and the bathroom floors using flush girder construction.
9. For the entire attic floor.

D. BRIDGING

EXPLANATION

"Cross bridging" is the term applied to the diagonal bracing which is fastened between consecutive lines of joists to stiffen the floor. They are usually placed in double rows crossing each other as illustrated below. Cross bridging is made of material varying from 1" or 2" thick and from 2" to 4" wide.

Cross bridging is nailed in double rows not more than 8'-0" apart, any span 8'-0" wide or over should have at least one (1) double row, and over 14'-0" should have two (2) rows.



CROSS BRIDGING

To estimate the lineal feet of cross bridging required for a floor, take the length in feet of the building, or area, at right angles to the direction of floor joists and multiply this by 3 for each double row of bridging required. If the span of the floor joist is 14' or under only one double row of bridging is necessary.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST AND CALCULATE THE BOARD FEET OF 1" x 3" BRIDGING REQUIRED FOR THE FOLLOWING FLOOR AREAS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. Under the Living Room.
2. Under the dining room and kitchen.
3. Under both chambers and bath.
4. For the entire attic floor.

E. ROUGH FLOORING

EXPLANATION

Rough flooring (sometimes called sub-flooring or floor lining) is estimated by adding a certain per cent to the area to be floored. The percentage to be added depends upon the width of the boards, whether or not they are matched and upon the normal waste in cutting.

For 1" x 6" matched boards applied at right angles to the the floor joists, add 20% for waste in matching and cutting; for 1" x 8" matched boards add 16%. Usually no allowance is to be made for openings.

An additional 5% is added when rough floorboards are to be laid diagonally.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST AND CALCULATE THE ROUGH FLOORING IN THE FOLLOWING PROBLEMS.

NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. The entire first floor area using 1" x 6" matched boards applied at right angles to the joists.
2. The entire first floor area using 1" x 8" matched boards at right angles to the joists.
3. The entire first floor area using 1" x 6" matched boards applied diagonally.
4. The entire first floor area using 1" x 8" matched boards applied diagonally.
5. The entire attic floor using specifications of Problem 1.
6. The entire attic floor using specifications of Problem 2.
7. The entire attic floor using specifications of Problem 3.
8. The entire attic floor using specifications of Problem 4.

F. STUDDING AND DRAFT STOPS

EXPLANATION

A common and fairly accurate way of estimating studs used in practice is to figure one stud for every lineal foot of walls and partitions when studs are set 16" o. c. This surplus allows for the doubling at corners and around openings. Studs are obtained in multiples of 2'-0" with the exception of one length of 9'-0".

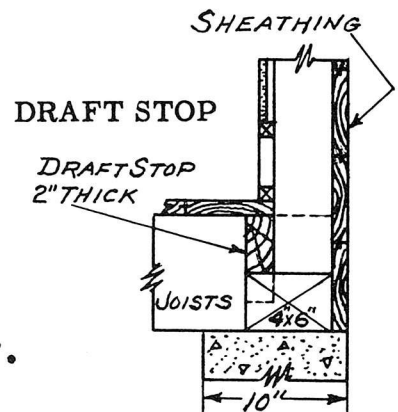
Studs for small frame buildings are seldom larger than 2" x 4" in cross section. Minor partitions are often made of 2" x 3" studs. The size for each partition is indicated on the drawing.

In taking off the lineal feet of walls and partitions for studding, start at one corner of the building and continue around the outside walls. Then measure the lineal feet of inside partitions running in one direction, then the partitions running at right angles to those just estimated. Repeat this for each story of the building.

Draft stops are estimated by the lineal foot of exterior wall at right angles to the floor joist and they are the same width as the floor joist.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST AND ESTIMATE THE STUDS IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. Front exterior walls, first floor.
2. Right side exterior wall, first floor.
3. Left side exterior wall, first floor.
4. Rear exterior wall, first floor.
5. Gable wall left side, plate to roof.
6. Gable wall right side, from plate to roof.
7. Gable wall rear, from plate to roof.
8. Interior bearing partition running from the front to the rear of the house.
9. Interior bearing partition dividing the living room from the dining room and kitchen.
10. All interior non-bearing partitions.
11. From this same set of plans list and estimate the draft stops for the entire job.



G. WALL PLATES AND SHOES

EXPLANATION

Top and bottom plates of walls and partitions are figured separately from the studs.

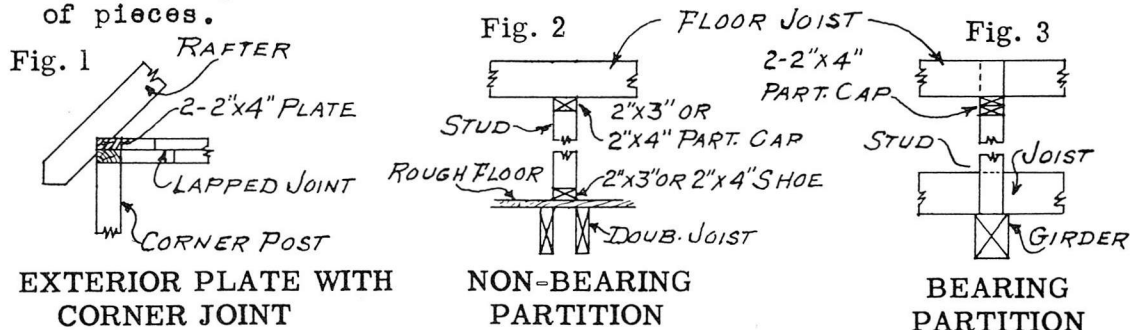
Plates running along the top of the studs on the exterior walls are usually made up of two 2" x 4" timbers nailed together with a lap joint at the corners. These usually act as a seat for the roof rafters. (See Figure 1.)

Bearing partition caps are made up of two 2" x 4" timbers running along the top of the interior bearing partition. No shoes for these partitions are required as the studs should rest directly on the floor girders. (See Figure 3.)

Non-bearing partitions require a partition cap running along the top of the studs and a shoe running along the bottom of the studs. These members are the same dimensions as the studs making up the partition i. e., usually 2" x 3" or 2" x 4". (See Figure 2.)

No allowance is made for openings in any of the above items.

When the total lineal feet is taken off, divide this total by the lengths you wish to order to determine the number of pieces.



USE THE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST AND CALCULATE THE BOARD FEET OF PLATES, SHOES, AND CAPS IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. Exterior plate on the front elevation.
2. Exterior plate on the left side elevation.
3. Exterior plate on the rear elevation.
4. Exterior plate on the right side elevation.
5. Interior bearing partition cap running from the front to the rear of the house.
6. Partition cap for the top of the bearing partition that separates the Living Room from the Dining Room and Kitchen.
7. Interior bearing partition cap between the Entry and the Kitchen.
8. All interior non-bearing partition caps.
9. All shoes under non-bearing partitions (no allowance being made for openings).

H. RAFTERS

EXPLANATION

The length of roof rafters may be figured by several different methods. The two most commonly used by building estimators will be used in solving the rafter problems on these sheets. The lengths of rafters figured in these problems will be the "line lengths" of rafters. Rafters are sold in multiples of 2' in length. One extra rafter should be added for a starter on roofs.

COMMON RAFTER LENGTHS BY THE SQUARE ROOT METHOD

Example: What is the length of the rafters of a gable roof which has a rise of 9', a run of 12' and an overhang of 1'?

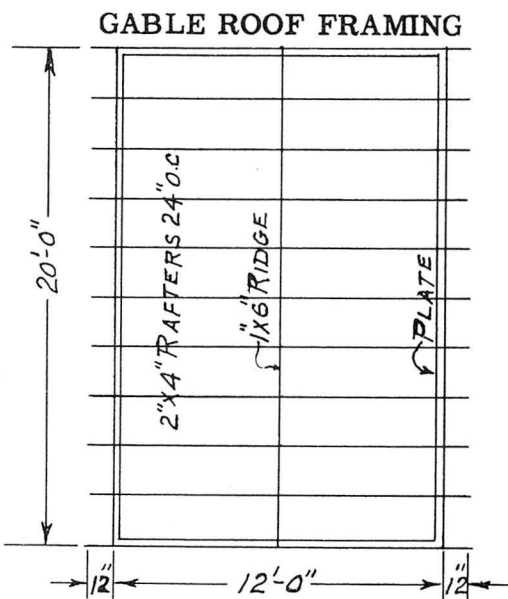
Note:- Overhang is not horizontal projection.

$$\begin{aligned} \text{Length of rafter} &= \sqrt{(\text{rise})^2 + (\text{run})^2} = \sqrt{(9)^2 + (12)^2} \\ &= \sqrt{81' + 144'} = \sqrt{225'} = 15'-0" \end{aligned}$$

Length of rafter = 15'-0" + 1'-0" overhang = 16'-0" rafter length

USING THE ABOVE METHOD, SOLVE THE FOLLOWING PROBLEMS.

- Find the length of the rafters in the gable roof, the framing plan of which is shown opposite, if they have a rise of 6" for every foot of run. A rafter projection of 1'-0" is to be figured in the rafter length.
- List the material and calculate the board feet of stock required for all of the rafters on the roof shown here.
- The gable roof of a house having a span of 24'-0" is 35'-0" long and has a roof rise of 8'-0". Make out a list, and calculate the number of board feet of stock to be ordered, if 2" x 6" roof rafters are used, spaced 20" o. c. and the horizontal projection of the rafter overhang is 16".
- List and calculate the stock required for the rafters of a gable roof with a span of 26'-0", a roof length of 39'-0", and a 1/2 roof pitch. Use 2" x 6" roof rafters spaced 18" o. c. and allow for an overhang having 1'-0" horizontal projection.
- List and calculate the board feet of stock required for the roof in Problem 1 if the roof has a 1/3 pitch.



H. RAFTERS

COMMON RAFTER LENGTHS BY CONSTANTS: (APPROXIMATE METHOD)

A table, used by estimators for computing the lengths of common rafters, is given below. Only the most common roof pitches are given.

Table #1

Rise	Run	Pitch	The Rafter Length is the Rafter Run in Ft. Multiplied by
6"	12"	1/4	1.118
8"	12"	1/3	1.202
9"	12"	3/8	1.250
12"	12"	1/2	1.414
16"	12"	2/3	1.666
18"	12"	3/4	1.802
24"	12"	Full	2.236

NOTE: Add the horizontal projection at the eaves to the rafter run.

Example: What is the length of the rafters of a gable roof which has a $1/3$ pitch, a roof span of 24'-0", and a horizontal projection of 1'-0" at the eaves?

Rafter run = 24'-0" \div 2 = 12'-0".

Rafter run and projection = 12'-0" \div 1'-0" = 13'-0".

Rafter length = 13'-0" \times 1.202 = 15.625 or 15'-7 $\frac{1}{2}$ ". Answer.

1. Using the table of constants given above, solve Problem 1, Sheet 8.
2. Using the table of constants given above, solve Problem 2, Sheet 8.
3. Using the table of constants given above, solve Problem 3, Sheet 8.
4. Using the table of constants given above, solve Problem 4, Sheet 8.
5. Using the table of constants given above, solve Problem 5, Sheet 8.

H. RAFTERS

HIP RAFTERS FOR EQUAL PITCH ROOFS

Square Root Method. (Accurate Method)

$$\text{Length of Hip Rafter} = \sqrt{(\text{rise})^2 + 2 (\text{run of common rafters})^2}$$

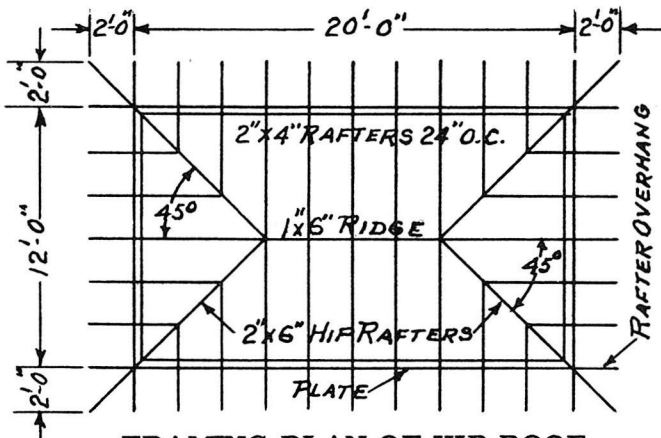
Example: A hip roof of equal pitch all around has a rise of 8'-0" and a run of 12'-0". What is the length of the hip rafters?

$$\begin{aligned} \text{Length of hip rafters} &= \sqrt{(\text{rise})^2 + 2 (\text{run})^2} \\ &= \sqrt{(8')^2 + 2 (12')^2} = \sqrt{64 + 2 \times 144} \\ &= \sqrt{352} = 18.761' \approx 18'-9 \frac{1}{8}" \end{aligned}$$

Rafter length = 18'-9 1/8"

USING THE ACCURATE METHOD, SOLVE THE FOLLOWING PROBLEMS:

- Find the length of the hip rafters on the plan below, if the roof has a 1/3 pitch.



The run of a jack rafter is always equal to its distance from the corner.

FRAMING PLAN OF HIP ROOF

- Figure the length of the hip rafters to be ordered in the roof shown above, if the roof has a 1/4 pitch.
- What would be the length of the hip rafters if the above roof had a rise of 9" for each foot of run?
- What would be the length of the hip rafters if the above roof had a rise of 12" for each foot of run?

H. RAFTERS

HIP RAFTERS FOR EQUAL PITCH ROOFS

Hip Rafter Lengths by Constants: (Approximate Method)

Table #2
Lengths of Hip or Valley Rafters

Rise	Run	Pitch	Run of Common Rafter Multiplied By
6"	12"	1/4	1.5
8"	12"	1/3	1.56
9"	12"	3/8	1.6
12"	12"	1/2	1.73
16"	12"	2/3	1.94
18"	12"	3/4	2.06
24"	12"	Full	2.45

NOTE:-

Add the length of horizontal projection at the eaves to the run.

Example: What is the length of the hip rafters of a roof with a $1/3$ pitch if the common rafter run is 12'-0" and the horizontal projection is 1'-0" at the eaves?
 Length of hip rafter = 12'-0" + 1'-0" x 1.56 = 20.28'
 Hip rafter length = 20'-3 3/8"

1. Using the table of constants, solve Problem #1, Sheet 10.
2. Using the table of constants, solve Problem #2, Sheet 10.
3. Using the table of constants, solve Problem #3, Sheet 10.
4. Using the table of constants, solve Problem #4, Sheet 10.

H. RAFTERS

JACK RAFTERS

Jack rafters extend from the wall plate to the hip or valley rafter, and are shorter than the common rafters. The run of a jack rafter is always equal to its distance from the corner. See plan of hip roof on Sheet 10. Jack rafter lengths are figured similar to common rafters.

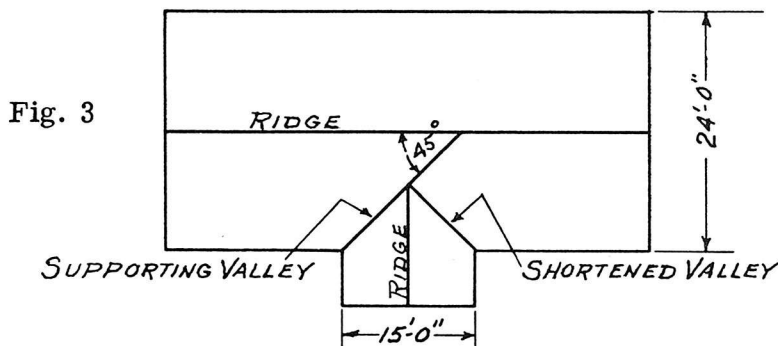
The common difference in length of each jack rafter may be found by counting the number of hip jacks that are to be placed between the corner of the building and the first common rafter, and dividing the line length of the common rafter by one more than the number of jacks to be used.

1. Figure the lengths of the jack rafters for the hip roof in Problem 1, Sheet 10.
2. Find the lengths of the jack rafters for the hip roof in Problem 2, Sheet 10.
3. Figure the lengths of the jack rafters in Problem 3, Sheet 10.
4. List and estimate all of the rafters required for the hip roof shown on the plan on Sheet 10, if the roof has a $1/3$ pitch.

VALLEY RAFTERS

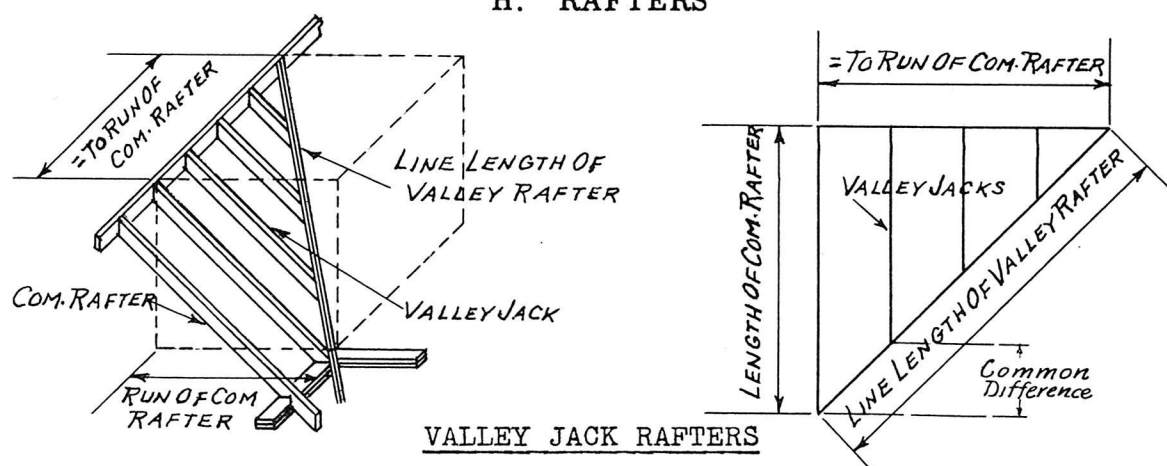
Valley rafters are figured in the same manner as hip rafters. A valley rafter is a sunken hip rafter.

5. Find the length of the supporting valley rafter shown on the plan below. The roof pitch is $1/3$.



6. Figure the length of the shortened valley rafter in the roof shown on the plan. The roof pitch is 8" rise to the foot.
7. List and calculate the board feet of stock required for the valley rafters on the rear side of the roof of a Five Room Bungalow. NOTE: Use Available Blueprints.

H. RAFTERS



Valley jack rafters are figured in much the same manner as hip jack rafters. A graphical way of determining their lengths is as follows:

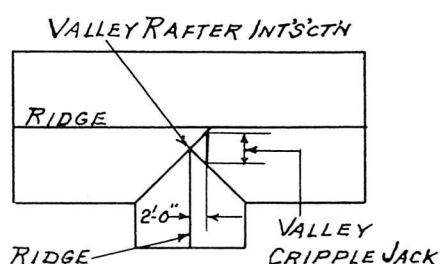
Draw to scale a right triangle, one leg representing the line length of the common rafter; and the other leg, the run of the common rafter. See diagram at right above. Space off the jack rafters their proper distance apart and draw them parallel to the leg representing the line length of the common rafter. The length of each "jack" or their common difference can then be scaled sufficiently close for estimating.

1. List the valley jacks required for the Five Room Bungalow, as used in Blueprint Reading Course.

VALLEY CRIPPLE JACKS

The run of a valley cripple jack is always twice its distance from the valley rafters intersection. See roof plan at right.

Example: The cripple jack is spaced 2'-0" from the valley rafter intersection. The run of the cripple jack equals $2 \times 2'-0"$ or 4'-0" rafter run.



USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW AND SELECT FROM THE FOLLOWING THOSE PROBLEMS THAT WILL APPLY.

2. List and calculate the board feet required for the cripple jacks of the roof of the Five Room Bungalow.
3. List and calculate the stock required for the entire roof frame of the Five Room Bungalow. Allow 2" extra in length for all hip, valley, and jack rafters for cheek cuts. The lengths you are taking off are all line lengths of rafters. For exact length, allowance should be made for plumb cuts at ridge and eaves.

I. SHEATHING AND ROOF BOARDS

EXPLANATION

Sheathing is the name given to the boarding which is applied directly to the outside face of the exterior wall studs. It is sometimes called sub-siding.

Sheathing may be nailed to the studding of a building either diagonally or horizontally.

To find the amount required, first figure the area to be covered, in sq. ft., and add a percentage, depending on the width of the boards. In using the percentages listed below, no deductions are to be made for openings.

For 1" x 6" matched sheathing nailed at right angles to the studs add 20%. For 1" x 8" matched sheathing add 16%. An additional 5% is added when boards are laid diagonally.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST AND ESTIMATE THE BOARD FEET OF SHEATHING FOR THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. Front elevation, 1" x 6" sheathing, applied horizontally.
2. Left side, 1" x 6" sheathing, applied horizontally.
3. Rear elevation, 1" x 6" sheathing, applied horizontally.
4. Right side elevation, 1" x 6" sheathing, applied horizontally.
5. Front elevation, 1" x 8" sheathing, applied horizontally.
6. Left side elevation, 1" x 8" sheathing, applied horizontally.
7. Rear elevation, 1" x 8" sheathing, applied horizontally.
8. Right side, 1" x 8" sheathing, applied horizontally.
9. Entire side walls, 1" x 6" sheathing laid diagonally.
10. Entire side walls, 1" x 8" sheathing laid diagonally.

Roof boarding is figured in the same manner as sheathing, except that it is rarely applied other than at right angles to the direction of the rafters.

11. Entire main roof not including porch, using 1" x 6" sheathing.
12. Entire main roof not including porch, using 1" x 8" sheathing.
13. Front porch roof, using 1" x 6" sheathing.
14. Front porch roof, using 1" x 8" sheathing.

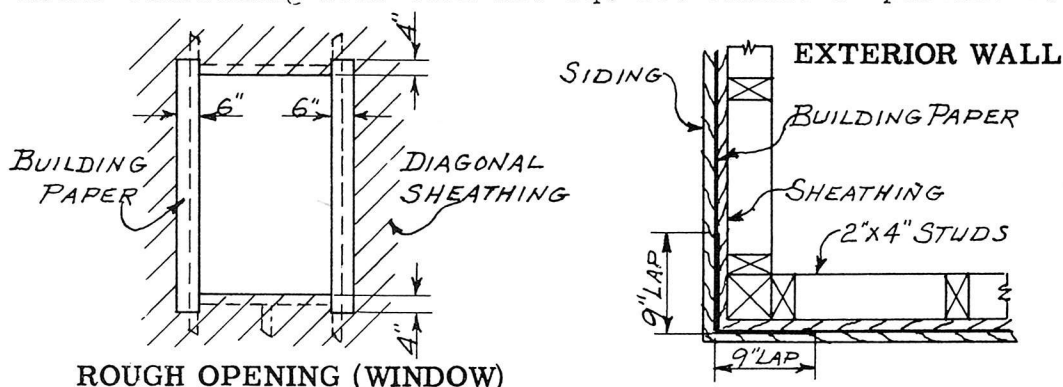
J. BUILDING PAPER

Building paper should be laid between the sheathing (sub-siding) and the outside finish. It is also used on some types of roofs between the sheathing and the finished roofing. It should lap 4" at the joints and lap around corners 9" both ways. This paper can be purchased in rolls 36" wide containing either 250 sq. ft. or 500 sq. ft.

In listing the sidewalls, the laps for joining will be taken care of if no deductions are made for window or door openings. On roofs, an addition of 12% should be added to the roof area for lap joints.

If the building paper used is not waterproof, a 6" strip of waterproofed paper should be placed on each side of the exterior door and window between the casing and the sheathing.

Rolls containing less than 250 sq. ft. cannot be purchased.



USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW; LIST AND ESTIMATE THE BUILDING PAPER REQUIRED IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

Answers for Problems 1 through 9 to be in square feet.

1. Exterior wall on the front elevation.
2. Exterior wall on the rear elevation.
3. Exterior wall on the right side elevation.
4. Exterior wall on the left side elevation.
5. Porch roof over the front entrance.
6. Front roof not including porch.
7. Rear roof over ell.
8. Rear roof not including ell.
9. Waterproofed paper both sides of all window openings.
10. How many 250 sq. ft. rolls of paper will be required for the exterior walls of the Five Room Bungalow?
11. How many 250 sq. ft. of rolls of paper will be required for the roof of the Five Room Bungalow?

K. FURRING AND GROUNDS

EXPLANATION

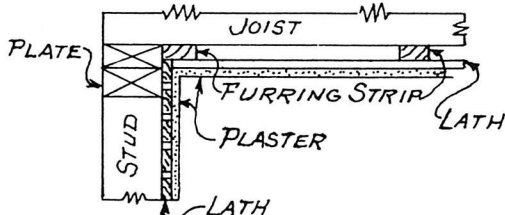
When wood laths are used and the studding is spaced not over 16" o. c. furring is not necessary. However, if some types of metal lath or other plaster base is to be used, furring may be necessary so that the points of nailing may be closer together. Very often metal lath is used for ceilings, being considered safer and because plaster applied upon it is less apt to show bad cracks. Metal lath, unless of the self-furring type, always requires nailing 12" on centers. This necessitates furring strips nailed to the bottom of the ceiling joists.

Furring strips to which ceiling laths are nailed are usually 1" x 2" wood strapping and are spaced either 12" or 16" o. c. They run at right angles to the floor joist.

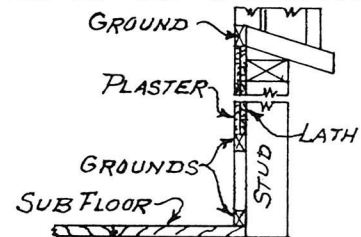
Grounds provide a surface for the plasterer to use in getting an even wall to receive baseboards, aprons, etc. with a tight fit, and provides a nailing for wood trim.

In estimating the quantity of grounds required for a job, take off the number of lineal feet around all door and window openings, add to this the amount required at the base and for wainscoting or chair rail. Make an allowance of 10% for waste and breakage. Seventeen lineal feet are ordinarily allowed for a door or window opening one side only of a partition or wall.

All strapping is estimated by the lineal foot. In counting the number of furring strips, always add one for a starter.



SECTION THRU CEILING



SECTION THRU WALL

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW AND LIST THE MATERIALS FOR THE FOLLOWING. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

Ceiling furring for following, adding 10% for waste:

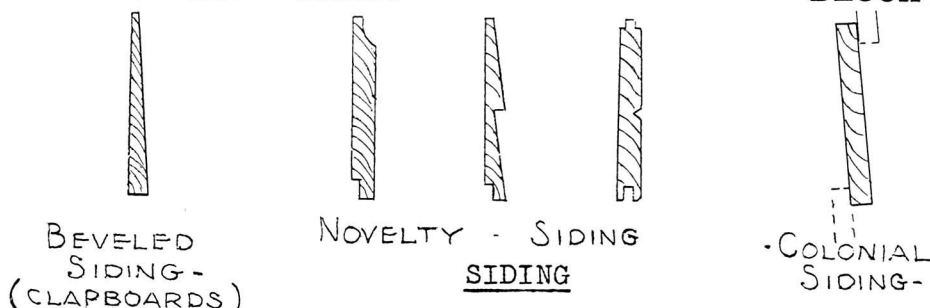
Grounds (size 3/4" x 1) for the following rooms:-

- | | |
|--|----------------------------------|
| 1. Living Room, Dining Room, Kitchen and Entry; 12" spacing. | 5. Living Room |
| 2. Both Chambers, Hall and Bathroom; 12" spacing. | 6. Dining Room |
| 3. Rooms in Prob. 1; 16" spacing. | 7. Kitchen |
| 4. Rooms in Prob. 2; 16" spacing. | 8. Entry |
| | 9. Bathroom and Hall |
| | 10. Both Chambers incl. Closets. |

BLOCK X-S OUTSIDE FINISH

A. WALL COVERING - SIDING

BLOCK X-S - SHEET 1



Clapboards and other types of siding are sold by the square foot. The surface area to be covered plus a percentage for lapping and waste will give the required number of square feet for that area.

The table below gives the allowance for lap and waste for various widths of beveled siding laid with usual exposures to the weather.

Width	Exposure to Weather	Add for Lap and Waste
12"	10 1/2	15%
12"	10	20%
10"	8 1/2	18%
10"	8	24%
8"	6 1/2	23%
8"	6	30%
6"	5	25%
6"	4 3/4	32%
6"	4 1/2	38%
4"	2 3/4	51%
4"	2 1/2	65%

The various types of novelty sidings (see drawing above) are figured similar to sheathing since they are usually made of 1" x 6" boards. Allowance for lap and waste on all 1" x 6" novelty siding is 25%. "Celotex" or other types of insulating board is sometimes applied between the sheathing and the siding. It comes in rectangular sheets 4'-0" wide and in even lengths from 8'-0" to 12'-0".

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW AND LIST THE REQUIRED MATERIALS IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. Celotex for the front elevation (deduct 50 sq.ft. for openings).
2. Celotex for the left side elevation.
3. Celotex for the rear elevation.
4. Celotex for the right side elevation.
5. Siding for the four sides laid 5" to the weather.
6. Siding for the four sides laid 4 3/4" to the weather.
7. Siding for the four sides laid 4 1/2" to the weather.
8. Siding for the four sides laid 2 3/4" to the weather.
9. Siding for the four sides laid 6 1/2" to the weather.
10. Siding for the four sides laid 8 1/2" to the weather.
11. Siding for the four sides laid 10" to the weather.

B. WALL COVERING - SHINGLES

Shingles are packed in bundles 20" wide and containing a certain number of courses, each containing 5 standard shingles. (4" is width of standard shingle though actually they come in random widths). The number of courses per bundle depends on the thickness of the butts and on the method of packing. The two common methods of packing are: "Thousand Pack" and "Square Pack". Following is a table showing standard packing practice:

Length	Butts in 2"	Thousand Pack		Square Pack	
		Courses	Bund. per M	Courses	Bund. per Sq.
16"	5 or 6	40	5	40	4
18"	5	40	5	36	4
24"	4	36	7	27	3

Shingles should be ordered by the "thousand" or by the "square".

In ordering by the thousand, keep in mind that a standard shingle is 4" wide. Then, having determined the exposure (distance to weather), the covering capacity of 1,000 shingles in square feet would be:

$$\frac{4" \times (\text{exp. in inches}) \times 1,000}{144"}$$

In ordering by the "square" method, it is necessary to know the "exposure basis" (the exposure at which a square will cover 100 square feet). Common practice is as follows:

<u>Length of Shingle</u>	<u>Exposure Basis</u>
16"	5"
18"	5 1/2"
24"	10"

Having the exposure in inches at which a square of shingles will cover 100 sq. ft., the coverage at any exposure can be determined on a proportional basis. For instance, at 7" exposure 18" shingles will cover $\frac{7}{5\frac{1}{2}}$ as much as at 5 1/2 exposure; at 4" exposure 18" shingles will cover $\frac{4}{5\frac{1}{2}}$ as much. At 9" exposure, 24" shingles will cover $\frac{9}{10}$ as much as at 10" exposure, etc.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW AND LIST THE SHINGLES REQUIRED FOR THE EXTERIOR WALLS IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

- Figure (by the thousand) 16" shingles with 6" exposure.
- Figure " " " 18" " " 6" " "
- " " " 18" " " 7 1/2" " "
- " " " 24" " " 10 1/2" " "
- " (by the square) 16" " " 5" " "
- " " " 16" " " 7" " "
- " " " 18" " " 8 1/2" " "
- " " " 24" " " 10" " "

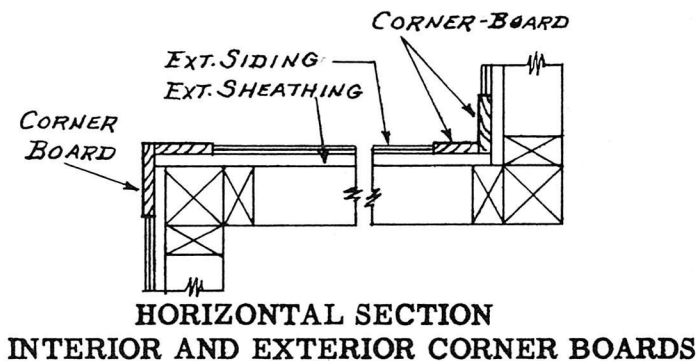
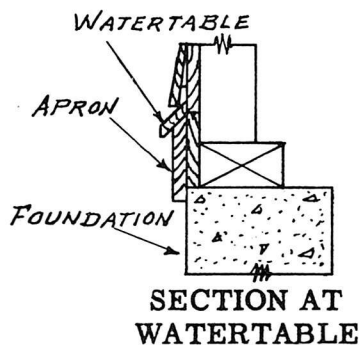
C. EXTERIOR TRIM

Mouldings, water tables, and gutters are ordered and listed by the lineal foot. Measurement of lattice work is based on the area, in sq. ft. to be covered. By using the table the lineal feet can be found. Other exterior trim is listed by the required lengths, widths, and thicknesses, and estimated by the board measure.

Table for Obtaining Lineal Feet of Lattice

7/8" lattice,	multiply sq. ft. by 14
1 1/4" lattice,	multiply sq. ft. by 11
1 1/2" lattice,	multiply sq. ft. by 9
2" lattice,	multiply sq. ft. by 7

NOTE: The above table is based on the strips being spaced so that the distance between will be equal to their widths. Add 10% for waste.



USE AVAILABLE BLUEPRINTS AND SPECIFICATIONS OF A FIVE ROOM BUNGALOW AND LIST AND ESTIMATE THE TRIM IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. If a 1" x 3" water table runs around the bungalow, how many lineal feet will be required?
2. If 1" x 5" and 1" x 4" corner boards were used in all exterior right angle corners, how much stock would be required and what lengths must be ordered?
3. The frieze board and bed moulding for the entire house.
4. The fascia board for the entire house.
5. The wood gutter for the entire house.
6. The rake moulding for the entire house.
7. Lattice work for the front and back porches.
8. Treads for front and back steps.
9. Floors for front and back porches.
10. Rail and balusters for front and back porches.
11. Blinds for the entire house.
12. Columns on the front porch.

D. ROOF COVERING

EXPLANATION

In estimating wood shingles for a roof, use the same methods as described on page 2 and order either by the "Square" or by the "Thousand".

The area of the roof should be increased by the extra course of shingles at the eaves and for each hip and valley. This added area is the product of the length of the course by the width of the exposed surface.

Asphalt shingles are ordered by the square and can be obtained in $\frac{1}{4}$ of a square if desired. As in wood shingles, the roof area is increased by the extra course at the eaves and for each hip and valley.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW AND LIST THE SHINGLES REQUIRED IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. Asphalt shingles for the front porch roof.
2. Asphalt shingles for the main front roof.
3. Asphalt shingles for the rear roof over the "ell".
4. Asphalt shingles for the rear roof not including the "ell".
5. Wood shingles by the square and thousand for the front porch roof laid $4 \frac{1}{2}$ " to the weather.
6. Wood shingles by the square and thousand for the front porch roof laid 5" to the weather.
7. Wood shingles by the square and thousand for the main front roof laid $4 \frac{1}{2}$ " to the weather.
8. Wood shingles by the square and thousand for the main front roof laid 5" to the weather.
9. Wood shingles by the square and thousand for the rear roof over "ell" laid $4 \frac{1}{2}$ " to the weather.
10. Wood shingles by the square and thousand for the rear roof, not including "ell", laid $4 \frac{1}{2}$ " to the weather.
11. Wood shingles by the square and thousand for the rear roof, not including "ell", laid 5" to the weather.

BLOCK XI-S

INTERIOR TRIM AND FINISH

A. WINDOWS AND WINDOW FRAMES

BLOCK XI-S - SHEET 1

WINDOWS

The two general types of windows used in carpentry are double-hung windows and hinged windows. Double-hung windows consist of two sash, (top sash and bottom sash) which slide vertically past each other. Windows consisting of one or more sashes hinged at the sides are called casement windows.

Sizes of sash and types of window frames vary slightly according to the manufacturers and the locality in which they are used. Refer to a catalogue on doors and windows.

To list a double-hung (D.H.) glazed window, proceed as follows:- Give width of glass in inches; height of glass in inches; thickness of sash rails; number of lights of glass in the window; and grade of glass.

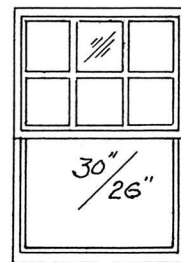
Example: List the D.H. window shown at the right.

One D.H. window, glass size 30" x 26", 1 3/8" sash
6 lights (lts.) glass - A.D.S.

1

The window weights and sash cord required for this window are usually supplied with the window and window frame. Be sure to list the sash required for each opening in mullion and triple windows separately.

THE BLUEPRINTED DRAWINGS OF THE FIVE ROOM BUNGALOW ARE TO BE USED FOR THOSE PROBLEMS THAT WILL APPLY TO THE BLUEPRINTS ON HAND.

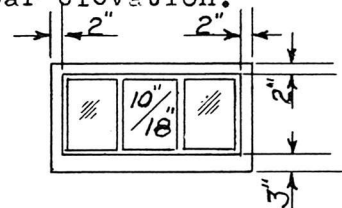


GLAZED WINDOW
DOUBLE HUNG

1. List the D.H. windows required for the front elevation.
2. List the D.H. windows required for the right side elevation.
3. Take off the D.H. windows shown on the left side elevation.
4. List the D.H. windows required for the rear elevation.

CELLAR SASH

The wood rails of the glazed cellar sash shown are 1 1/8" thick (New York size). To list a cellar sash, give the number of lights of glass in the sash, the glass width in inches, the thickness of the sash rails, and the kind of glass.



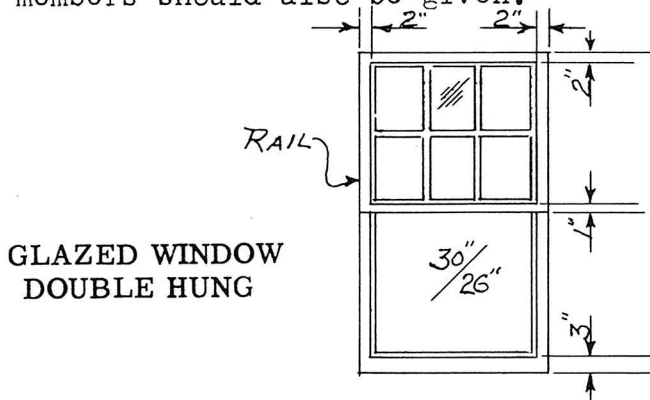
GLAZED CELLAR SASH

Example: One glazed cellar sash, 3 lts., 10" x 18", 1 1/8".
A.S.S. glass.

5. List the glazed cellar sash required for the Five Room Bungalow.

A. WINDOWS AND WINDOW FRAMES

To list the window frames required for a D. H. window, in a frame building, give the outside dimensions of the sash (sash opening) and the thickness of exterior walls. Unless a standard built frame of recognized good workmanship and materials is available, the materials, thickness, and design of the various members should also be given.



Example: List the frame for the D. H. window shown above.
(New York size)

Width of sash = $30'' + 4'' = 34'' = 2'-10''$

Height of sash = $2 \times 26'' + 6'' = 58'' = 4'-10''$

Outside dimensions of window = $2'-10'' \times 4'-10''$

LISTING

1-2'-10" x 4'-10" D. H. window frame 5 1/4" jambs for frame walls.

When ordering mullion or triple frames, be sure to state the width of the mullion usually either 6" or 8" for D. H. windows.

NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUE-PRINTS ON HAND.

1. Make out a list of the single D. H. window frames to be ordered for the windows having a glass size of 20" x 18" on the Five Room Bungalow.
2. Take off a list of the mullion, D. H. window frames required for the Five Room Bungalow.
3. List the single D. H. window frames required for the sash having a glass size of 26" x 24".
4. List the frames required for the cellar sash of the Five Room Bungalow. Refer to sketch of the glazed cellar sash on Sheet 1.

B. DOORS AND DOOR FRAMES

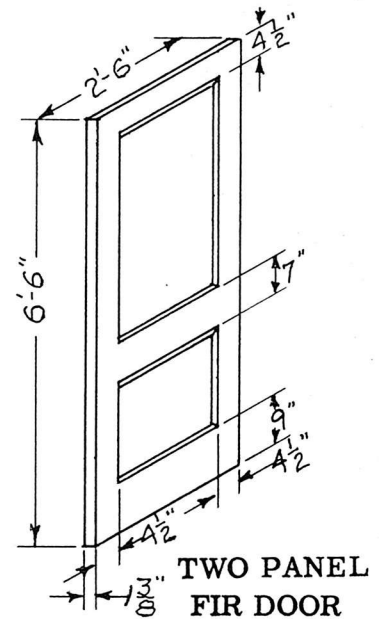
DOORS

When ordering doors, mention the door size, (width, height and thickness) style, and kind of wood, and whether solid or veneered. See manufacturer's catalogue on doors.

Example: List the door shown in the sketch opposite. One 2'-6" x 6'-6" x 1 3/8" two panel fir door.

THE BLUEPRINTS OF THE FIVE ROOM BUNGALOW ARE TO BE USED FOR THE FOLLOWING PROBLEMS:
NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

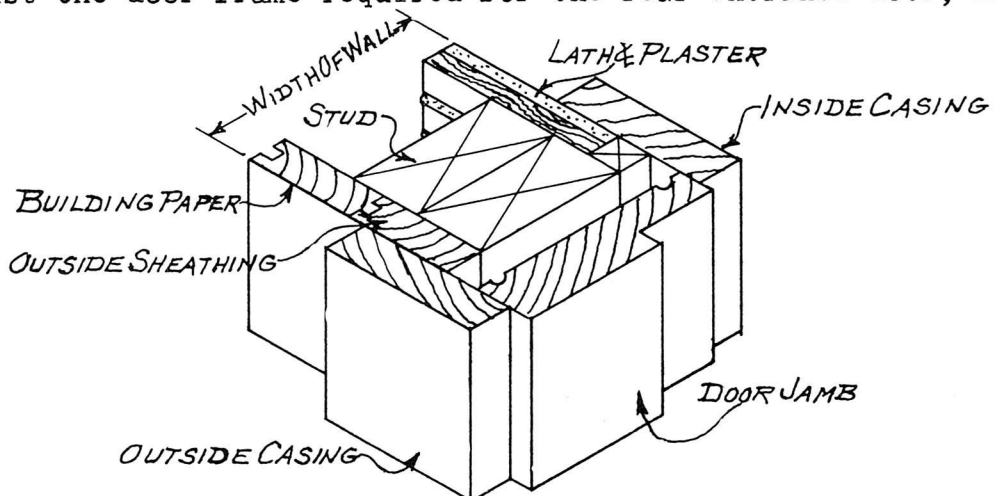
1. List the front door so that it could be ordered.
2. Make out a list of all interior doors marked "B".
3. List the interior doors marked "C".
4. List the exterior rear door.



EXTERIOR DOOR FRAMES

When ordering exterior door jams or frames, mention the kind of wood, width and thickness of jamb, whether for frame or masonry wall, size and thickness of door. Specify the kind of wood wanted for the door sill. Refer to the sketch and manufacturer's catalogue.

5. List the door frame required for the front entrance door, Problem 1.
6. List the door frame required for the rear entrance door, Problem 4.



C. STAIRS AND DOOR JAMBS

THE BLUEPRINTED DRAWINGS AND SPECIFICATIONS OF THE FIVE ROOM BUNGALOW ARE TO BE USED IN TAKING OFF THE INTERIOR TRIM AND FINISH IN THE FOLLOWING PROBLEMS. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

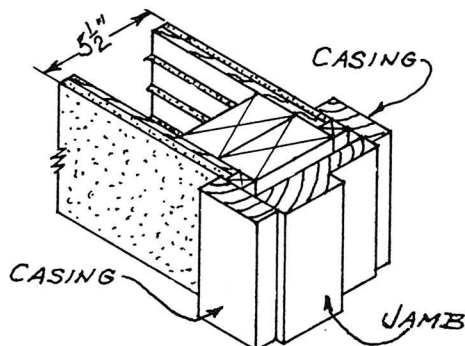
Read the section on "Inside Finish" in the specifications carefully and determine what types and kinds of materials are to be used in the house; then, where possible, list the material to be ordered for each room of the house separately.

STAIRS

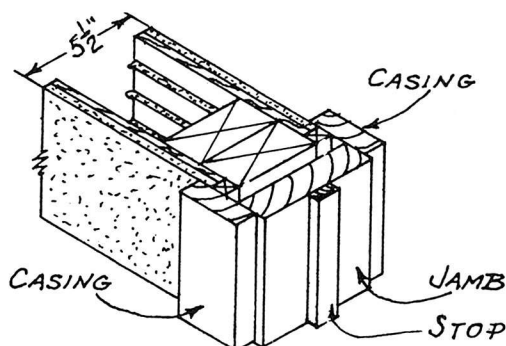
1. List the material required for the cellar stairs. Give the size of the treads, riser, rails, and newel posts and the type and kind of materials that are to be used.
2. List the folding stairway so that it can be ordered.

DOOR JAMBS

3. Make out a list of the jambs for all interior doors. State the number of door jambs, the kind of material, the thickness, the width, and type of door jamb (see sketch of door jambs). Give the door size in width, height, and thickness.



INTERIOR DOOR JAMB
RABBETED



INTERIOR DOOR JAMB
WITH STOPS PLANTED ON

Example of listing door jambs:

<u>No.</u>	<u>Material</u>	<u>Size of Jamb</u>	<u>Type</u>	<u>Door Size</u>
6	N.C. Pine	1 1/8" x 5 1/2"	Rabbetted	2'-6" x 6'-6" x 1 3/8".

D. INTERIOR TRIM - CABINETS

DOOR TRIM

Interior door trims consist of the casing which covers the joint between the jamb and plaster and forms the finish for the opening.

NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUE-PRINTS ON HAND.

1. The door trim is to be listed according to the number of sides of trim. An interior door has two sides of interior trim; an exterior door has but one side. (The exterior casings for an outside door are usually ordered with the door frame.) The type (moulded or plain), the kind of material to be used, and the size of the door opening must also be specified. State width and thickness of door trim whenever possible. Very often it is possible to select a style of trim from a catalogue so that it may be ordered by giving the window size, the style and material. List the interior door trim in the Five Room Bungalow. Take off each room separately.

WINDOW TRIM

2. The window trim is to be taken off by stating the size of the window opening, the type, the material of which it is to be made, the number of members and their sizes in width and thickness wherever possible. Very often it is possible to select a style of trim from a catalogue so that it may be ordered by giving the window size, the style, and material. List all the interior window trim for the first floor of the Five Room Bungalow.

BASE, BASE MOULDING, AND SHOE MOULDING

3. Take off the total distance around the room making no allowance for wall openings. List lengths of the base, base moulding, and shoe moulding to be ordered. State: width and thickness of base, width of mouldings, and the pattern and material to be used.

PICTURE MOULDING AND CHAIR RAIL

4. The picture moulding and the chair rail are to be figured in the same manner as the base and the shoe moulding after you know in which rooms they are to be placed. Consult the specifications and list the above named members for the Five Room Bungalow.

SHELVING, WARDROBE STRIP, AND HANGING RODS

5. List the width, thickness, and length of the shelving and wardrobe strips and clothes poles in each closet of the Five Room Bungalow. Figure the shelving cleat that is required together with the type of material to be used.

CABINETS

6. List the following cabinets to be ordered for the Five Room Bungalow: Medicine cabinet, Kitchen cabinet, Ironing board cabinet.

E. FLOORING AND PAPER

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW AND SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BLUEPRINTS ON HAND.

BUILDING PAPER

Building paper of various kinds is used between the rough and finish flooring. The purpose of the paper is to stop dust or drafts and, to some extent, to insulate against temperature and sound. So called "rosin-sized" paper is a common paper for this purpose. Damp-proof papers are also commonly used while, if a greater degree of insulation is desired, there are many grades of deadening felt or quilt on the market.

1. How many square feet of rosin-sized paper will be required between the sub-floor and the finish floor of the Living Room if the paper is given a 3" lap? Rosin-sized paper comes in rolls 36" wide.
2. How many square feet of paper will be required for the Dining Room, using the same lap?
3. Figure the amount of paper that will be required for the Kitchen floor, allowing the same lap.
4. How many square feet of paper will it take for the floors of the two Bedrooms, using a lap of 3"?
5. How many rolls of rosin-sized paper 36" wide and 100'-0" in length are to be ordered for all the rooms on the first floor of the Five Room Bungalow if each sheet has a lap of 3"?

FINISH FLOORING

If an allowance of 40% is made for waste and matching of $2\frac{1}{4}$ " face flooring, estimate the flooring required for the following rooms:

6. The Living Room.
7. The Dining Room.
8. The Kitchen.
9. The Bedrooms.
10. The Hall and Entry.
11. The Closets.

BLOCK XII-S

ESTIMATING HARDWARE

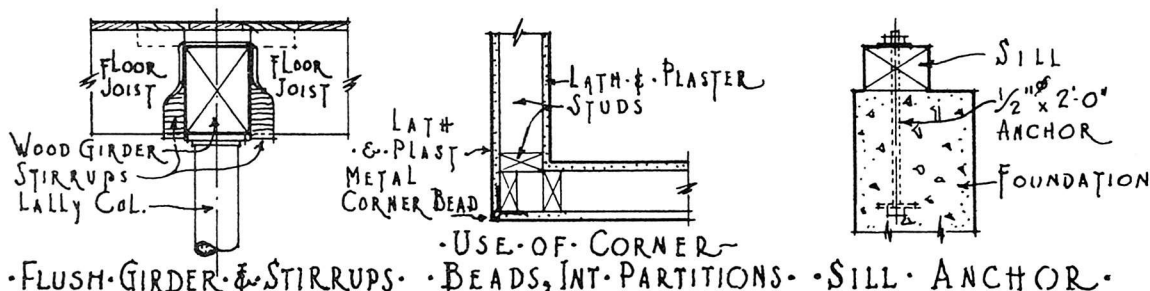
A. ROUGH HARDWARE

BLOCK XII-S - SHEET 1

Under the general heading of Rough Hardware are included the following items: nails of all description, bolts and screws, stirrups and hangers, anchors, tie rods, etc.

NAILS REQUIRED FOR CARPENTRY WORK

Kind of work	Size of Nails	Pounds per Square	Pounds per 100 Lineal Ft.
Beveled Siding	6-d	1 3/4	
Studs 16" o.c.	12-16-d	2	
Furring strips	8-d	1/2	
Wood grounds	8-d		1
Wood shingles 4 1/2" to the weather	3-d	5 3/4	
Joists & Rafters	20-d	15 lbs. per 1000 Bd. Ft.	



• FLUSH GIRDER & STIRRUPS • BEADS, INT. PARTITIONS • SILL ANCHOR •

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW. SELECT AND SOLVE THOSE PROBLEMS THAT WILL APPLY TO THE BLUEPRINTS ON HAND.

1. List and estimate the nails required for the exterior studs.
2. List and estimate the nails required for the interior studs.
3. List and estimate the nails required for the rafters of all roofs.
4. List and estimate the nails required for the floor and ceiling joists.
5. List and estimate the nails required for the furring strips on all interior ceilings.
6. List and estimate the nails required for the wood grounds in the entire house.
7. List and estimate the nails required for wood shingles on the roof laid 4 1/2" to the weather.
8. If drop girder construction is to be used, estimate the number of stirrups required to do the job.
9. If 1/2" round anchor bolts 24" long are used to bolt the sills to the foundations, list the number needed if they are spaced 5'-0" o. c. and two are used at each corner and for each lap.
10. List and estimate the metal corner beads for the exterior corners of all partitions. They come in multiples of one foot, from the 6'-0" lengths to the 12'-0" lengths.

B. SHEET METAL AND IRON WORK

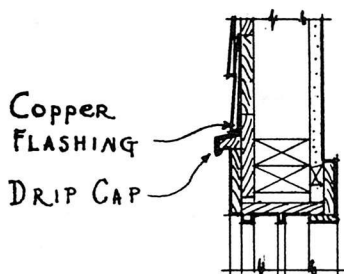
Under the heading Sheet Metal are included the following items:- copper lining for gutters, roof flashing, flashing for overhangs, metal roofings, eave troughs, etc.

Under the heading Iron Work are included the following items:- iron railings, grilles, gratings, conductor boots, etc. Not all of the above items will be found on all buildings.

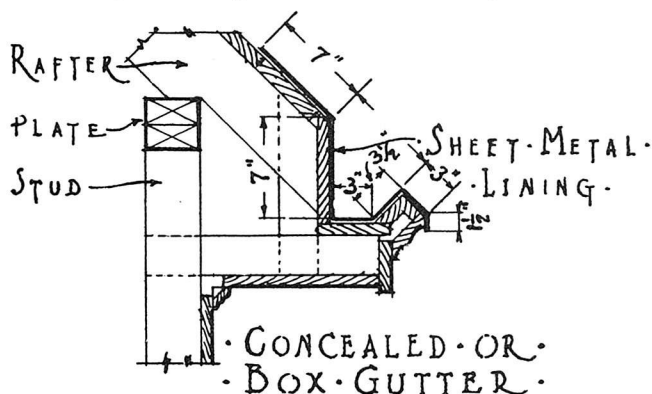
The copper flashing that covers the drip strip over the window runs the full length of the strip.

Valleys can be flashed by using a single strip of metal the length of the valley that is to be flashed.

The distance from the ground to the roof will determine the length of the rain water leader. Always list the required size and lengths.



· WINDOW HEAD ·
· FLASHING ·



USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW. LIST AND ESTIMATE THE METAL AND IRON WORK PROBLEMS THAT WILL APPLY TO THE BLUEPRINTS ON HAND.

1. Lineal feet of 16 ounce (oz.) copper flashing 4" wide over the windows in the front elevation.
2. Lineal feet of 16 oz. copper flashing 4" wide over the windows in the left side elevation.
3. Lineal feet of 16 oz. copper flashing 4" wide over the windows in the rear elevation.
4. Lineal feet of 16 oz. copper flashing 4" wide over the windows in the right side elevation.
5. Lineal feet of 16 oz. copper flashing 8" wide required for the roof valleys shown on the front elevation.
6. Lineal feet of 16 oz. copper flashing 8" wide required for the valleys shown on the rear roof elevation.
7. Lineal feet of 3" corrugated, round, galvanized iron leaders.
8. Number of 3" corrugated, round, galvanized iron shoes and gutter outlets.
9. Number of 3" corrugated, round, galvanized iron elbows.
10. If the Five Room Bungalow was to have a concealed type gutter similar to the sketch above, how many square feet of 16 oz. copper would be required to flash it? Add 5% for seams and gutter ends.

C. TRIMMING HARDWARE

All 1 3/4" thick exterior doors should have three 4" x 4" loose pin butts.

All 1 3/8" thick interior doors should have two 3 1/2" x 3 1/2" loose pin butts. (Sometimes three 3 1/2" x 3 1/2" butts are used in good construction.)

Lock sets for doors are specified as "interior" or "exterior". They vary considerably as to quality and are usually selected by the owner.

Two sash lifts are required for each double-hung window and one sash fastener.

Five stop bead caps and screws are required for each bead.

Each door should be equipped with a metal door stop.

Double action doors are to be equipped with 2 double action spring butts and a pair of glass push plates.

Kitchen cabinets should have two butterfly hinges for each door; a cupboard turn-catch for each door, and one elbow catch for double doors. Each drawer is to have 2 drawer pulls.

Medicine cabinets have two butterfly hinges and one turn-catch.

The ironing board cabinet door is equipped with three butterfly hinges and one turn-catch. Three sets of butterfly hinges are used for the board and its support.

KEEPING IN MIND THE ABOVE NOTES, USE THE BLUEPRINTED DRAWINGS OF THE FIVE ROOM BUNGALOW AND LIST THE TRIMMING HARDWARE FOR PROBLEMS THAT APPLY TO THE AVAILABLE BLUEPRINTS.

1. Windows in the Living Room.
2. Windows in the Dining Room.
3. Windows in the Kitchen and Entry.
4. Windows in the Rear Chamber and Bathroom.
5. Windows in the Front Chamber.
6. Doors marked "A".
7. Doors marked "B".
8. Doors marked "C".
9. Doors marked "D".
10. Medicine Cabinet.
11. Ironing board cabinet, complete.
12. The kitchen cabinet, if it has two doors in the upper section, one door in the lower section, and three drawers.

BLOCK XIII-S
ESTIMATING LABOR

A. FRAMING, OUTSIDE COVERINGS, TRIM

BLOCK XIII-S - SHEET 1

WHEN SOLVING THE PROBLEMS IN THIS UNIT, USE THE APPROXIMATE FIGURES GIVEN IN THE TABLE BELOW.

Average work accomplished by one man per 8 hour day.

<u>Kinds of Framing</u>	<u>Lumber Framed</u>
Sills	700' B. M. (Board Measure)
Joists	1500' B. M.
Rough Floor (right angles to joists)	1400' B. M.
Rough Floor (diagonally)	800' B. M.
Studs (walls and partitions)	600' B. M.
Plates and shoes	700' B. M.
Rafters (gable roof)	640' B. M.
Rafters (hip roof)	450' B. M.
Rafters (difficult roof)	400' B. M.
Sheathing, sidewalls	760' B. M.
Sheathing, sidewalls (diagonally)	350' B. M.
Clapboards	250 Sq. Ft.
Furring and grounds	1000' (lineal)
Shingles (4 1/2" to weather)	1500

USING THE BLUEPRINTED DRAWINGS OF THE FIVE ROOM BUNGALOW ESTIMATE THE HOURS OF LABOR REQUIRED IN THE PROBLEMS BELOW. NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BLUEPRINTS ON HAND.

1. Sills
2. First and second floor joists.
3. Rough flooring on the first floor, laid diagonally.
4. Rough flooring on the second floor, laid at right angles to floor joist.
5. Studs on exterior walls.
6. Studs for interior partitions.
7. Plates and shoes.
8. Roof rafters (difficult construction)
9. Sheathing sidewalls (making no deduction for openings).
10. Sheathing sidewalls diagonally (making no deductions for openings).
11. Sheathing the roof at right angles to the rafters.
12. Clapboards for the entire house.
13. Furring on the ceilings for the entire house.
14. Double grounds around the base of all rooms (make no deduction for openings).
15. Wood shingles 4 1/2" to weather for the entire roof.

B. FLOOR LAYING

A carpenter can lay, scrape the joints and sand approximately 2 squares of finish flooring in eight hours. For estimating purposes, the actual area of the floor (not the board measure) should be used.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW TO ESTIMATE THE HOURS OF LABOR TO COMPLETE THE WORK IN THE FOLLOWING PROBLEMS.

NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BUNGALOW BLUEPRINTS ON HAND.

1. Laying the hardwood floor, and scraping and sanding the entire surface in the Living Room.
2. Laying the hardwood floor, and scraping the joints and sanding in the Living Room.
3. Laying the hardwood floor, and scraping and sanding the entire surface in the Dining Room.
4. Laying the hardwood floor, and scraping the joints and sanding in the Dining Room.
5. Laying the hardwood floor, and scraping and sanding the entire surface in both chambers, not including the closets.
6. Laying the hardwood floor, and scraping the joints and sanding in both chambers, not including the closets.
7. Laying the hardwood floor, and scraping the joints and sanding in the hall and the four closets if 30% is added for extra time in cutting.
8. Laying the hardwood floor, and scraping and sanding the entire surface in the hall and the four closets if 30% is added for extra time in cutting.
9. Laying the hardwood floor, and scraping the joints and sanding in the Entry if 20% is added for extra time in cutting.

C. CONCRETE FORMS

A carpenter can build and erect approximately 42 square feet of concrete form work for foundation walls, footings, and piers of a dwelling house in one hour.

In estimating form work, no allowance is made for openings.

USE AVAILABLE BLUEPRINTS OF A FIVE ROOM BUNGALOW FOR ESTIMATING THE HOURS OF LABOR FOR THE FORM WORK IN THE FOLLOWING PROBLEMS.
NOTE: SELECT THOSE PROBLEMS THAT WILL APPLY TO THE BLUEPRINTS ON HAND.

1. Twelve inch concrete piers and 20" footings under the front porch.
2. Footings under all lally columns, piers, and chimney.
3. Footings under the front and rear foundation walls.
4. Footings under the left and right side foundation walls.
5. Foundation walls under the front of the house.
6. Foundation walls under the rear side of the house.
7. Foundation walls under the right side of the house.

BLOCK XIV-S
ADVANCED PROBLEMS

A. CONCRETE FORMS

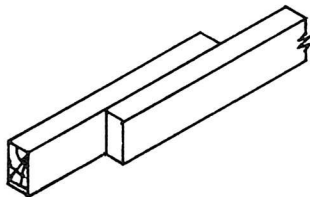
BLOCK XIV-S - SHEET 1

REFER TO THE DETAILS ON SHEET 2 AND SOLVE THE FOLLOWING PROBLEMS

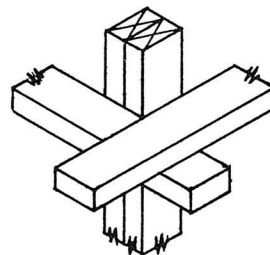
1. Having a house foundation to build which is 28 feet x 32 feet measured from outside to outside of concrete wall, how many lineal feet of 1" x 8" boards do we need for footing forms? The wall is 12" thick and the footing, which is to be 8" high, projects 4" beyond face of wall each side.
2. How many board feet in these footing forms?
3. How many studs, 2'-0" on centers, are needed for the wall forms? Wall is to be 7'-6" high above top of footing.
4. How many board feet in the studs that are required?
5. How many board feet of 1" x 8" N.C. T & G roofers are needed to sheath this form?
6. What will the length of the tie-wires have to be (allowing 12" for twisting)?
7. How many lineal feet of "Rangers" are needed?
8. How many board feet of "Rangers" will be needed?

NOTE:-

Whatever lengths of 2" x 4" stock are available can be used for rangers. They need not be cut but can be lapped by each other. At outside corners they can be lapped so as to form a right angle (See figures.)



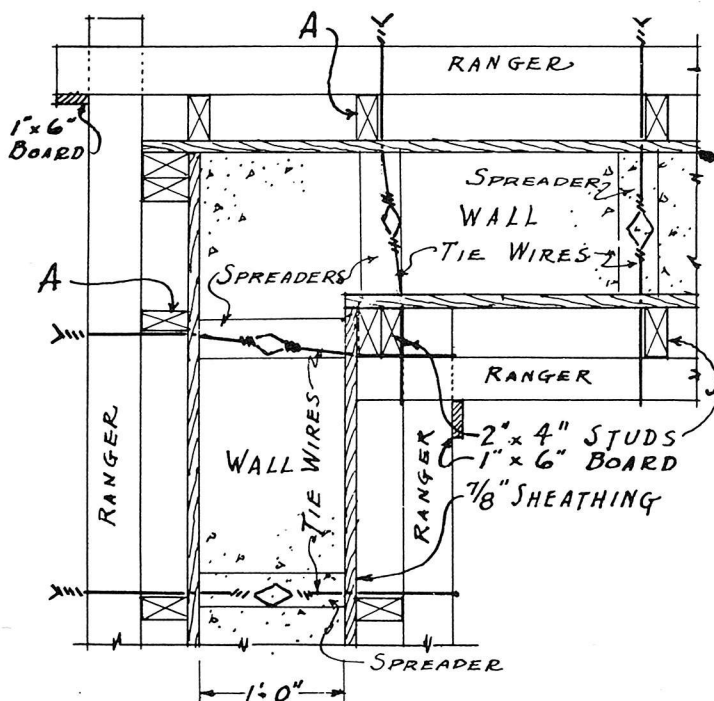
SIDE LAPPING



LAPPING AT CORNERS

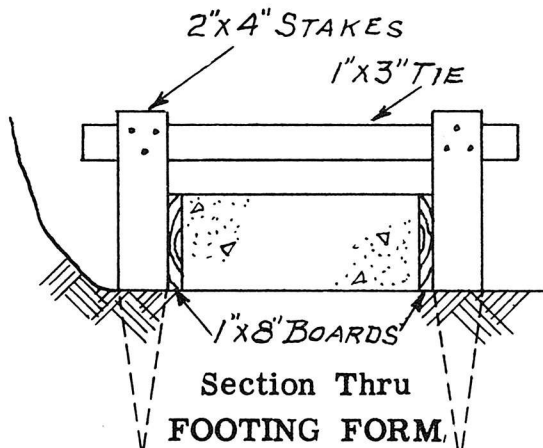
DETAILS OF RANGERS

A. CONCRETE FORMS

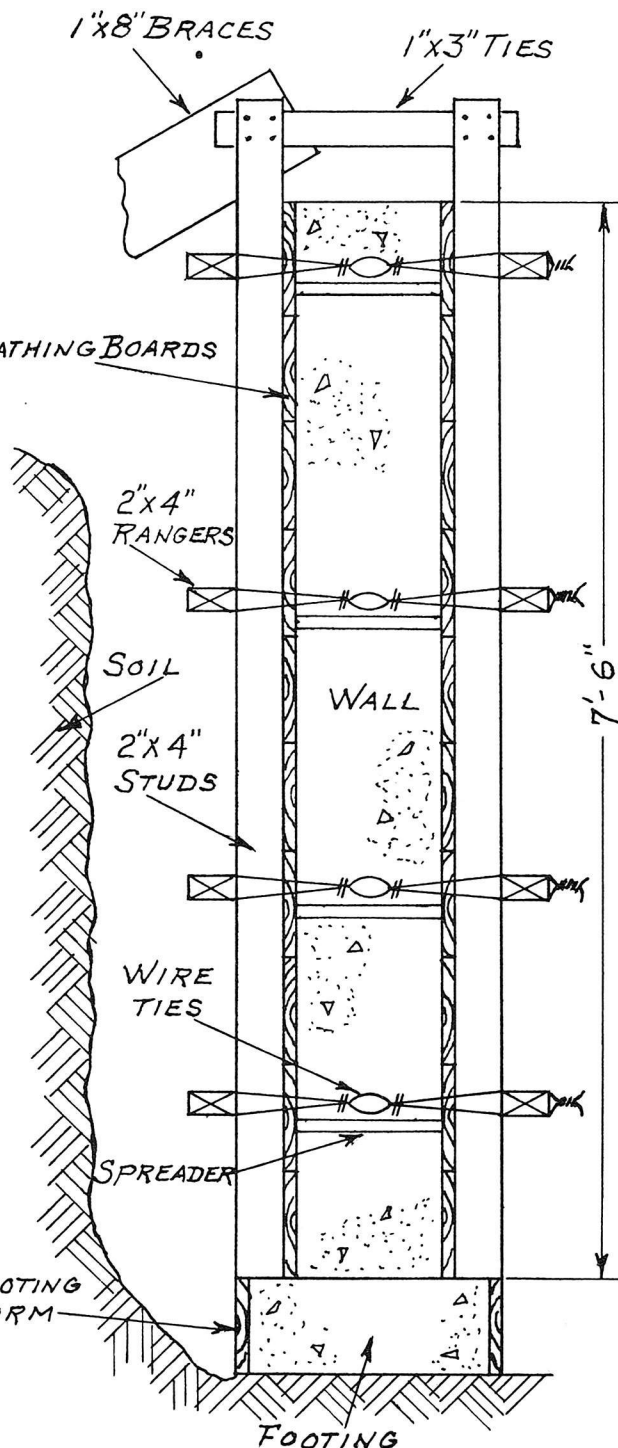


HORIZONTAL SECTION
AT CORNER

Studs are spaced 24" O.C. except those marked "A" which are always placed opposite the inside corner.



Showing method of holding
form boards in place.

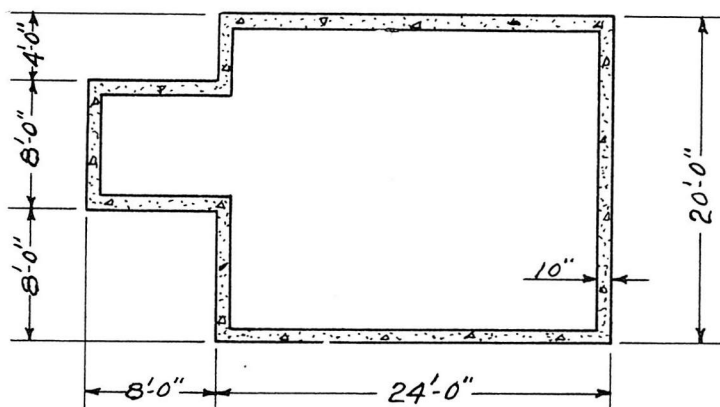


TYPICAL VERTICAL SECTION

DETAILS OF FOUNDATION FORMS

Scale - $\frac{3}{4}" = 1' - 0"$

A. CONCRETE FORMS



Note:- Wall to be 6'-6" high above footing, and 10" thick.

REFER TO THE ABOVE PLAN AND TO THE DETAILS ON SHEET 2 AND SOLVE THE FOLLOWING PROBLEMS.

1. Determine how many studs are needed for the foundation wall forms.
2. How many board feet of material are in the studs (2" x 4")?
3. How many board feet of 1" x 8" T & G sheathing will be needed?
4. What length of 2" x 4" timbers will serve best for rangers?
5. How much wire (lineal feet) will be needed for all the tie wires on this job?
6. How many cubic yards of concrete are in this wall?

FORMULA FOR DETERMINING THE CUBIC CONTENTS OF A WALL (IN CUBIC FEET).

Lineal feet of wall x thickness in feet x height in feet.

B. MEASUREMENTS

1. Find the exact length of the stud-
ding used in the framing section
shown at the right.
2. What is the distance between the
finished first and finished sec-
ond floor lines?
3. What is the distance from the top
of the foundation sill to the top
of the ribbon board which supports
the 2nd floor joists?
4. Find the distance from the top of
the second floor ribbon to the top
of the third floor ribbon.
5. What is the total height from the
top of the cellar floor to the top
of the plate?
6. Give the depth of the excavation
from the grade to the bottom of the
footing.
7. How far is it from the bottom of
the first floor joists to level of
soil under concrete floor?
8. What is the distance from the top
of cellar floor to top of finish
first floor?
9. Determine the number of steps nec-
essary for cellar stairs if the rise
of each step must be approximately
8".
10. Will the material for the bottom
riser be the same width as the other
risers? See Figure 2.

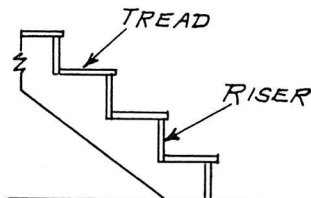


Fig. 2

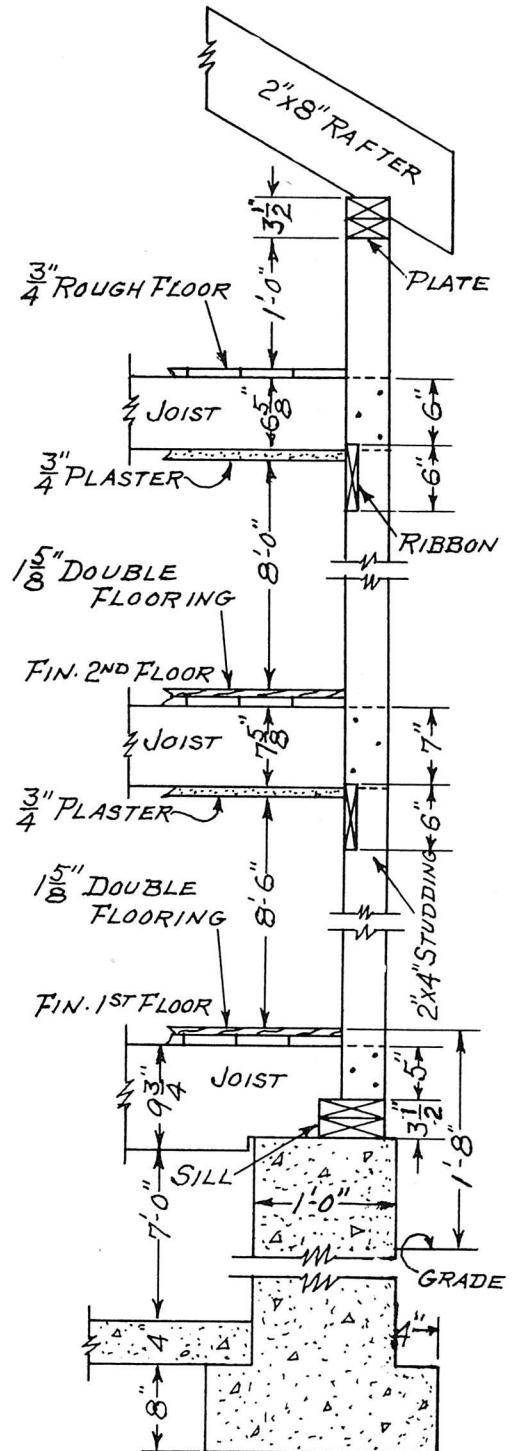


Fig. 1

C. MISCELLANEOUS

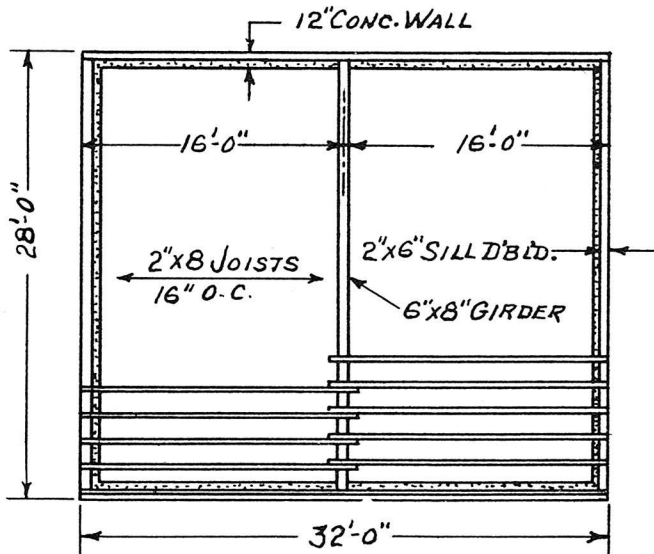
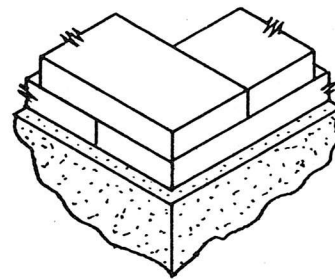


Fig. 3



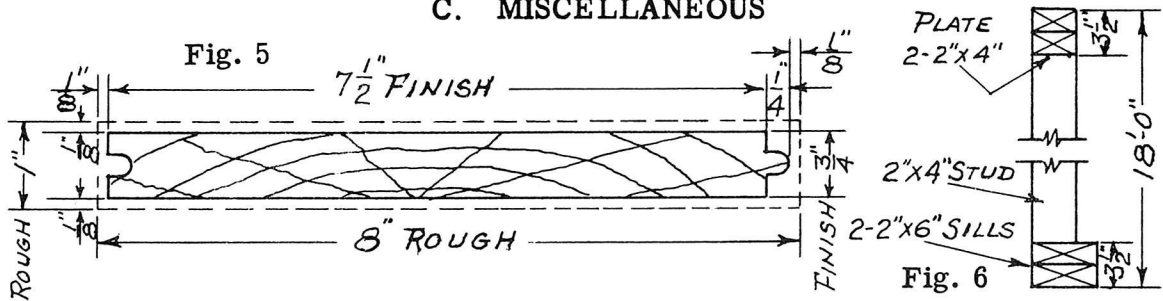
LAPPING OF SILLS
AT CORNERS

Fig. 4

NOTE:- All framing material must be ordered in multiples of 2'-0" in length.

1. How many board feet of material are in the sills shown in the above framing plan?
2. If the girder has a bearing of 8" on each wall, what is its length? Find the number of board feet contained in it.
3. How many joists will be required if they are started at a point 5" from the outside face of a wall?
4. At \$44.60 per M, what will the sills cost?
5. What will the joists cost at the same price? The joists rest on top of the girder and the ends should lap not less than the width of the girder.
6. Find the cost of the girder at the price given in Problem 4.
7. How many square feet of floor area are in the cellar shown above if a space, measuring 2'-6" x 7'-0", is deducted for a chimney foundation which is not shown on the plan?
8. How many cubic yards of earth must be excavated for this house, if excavated to an average depth of 5'-6", and an allowance of 18 inches is made around the outside of the foundation for room to set forms?

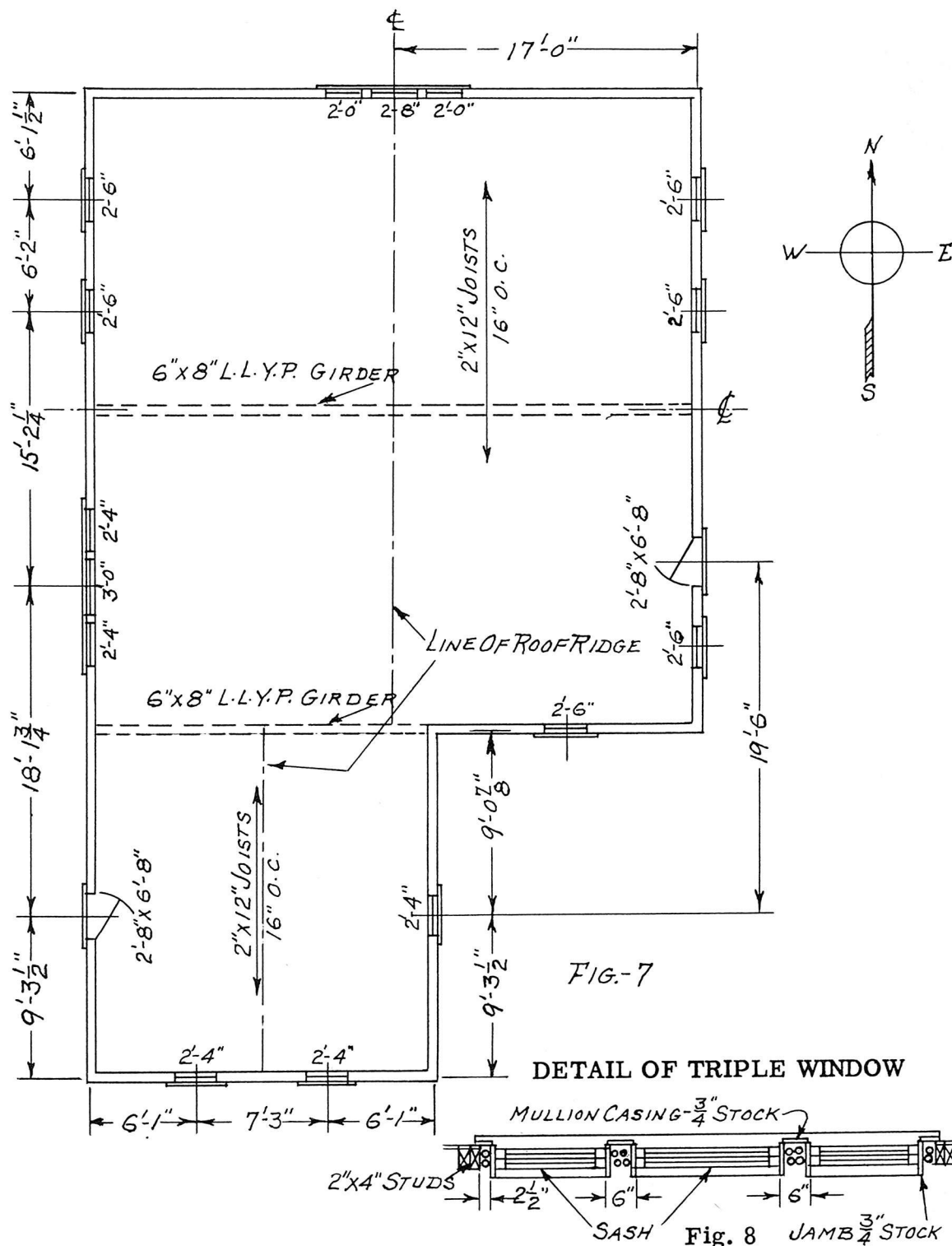
C. MISCELLANEOUS



The above sketch, Figure 5, illustrates the waste in milling flooring stock. An extra allowance also must be made for waste in cutting. For 8" or 10" widths of stock add $\frac{1}{4}$, and for 2" or 3" widths of stock add $\frac{1}{3}$ to the calculated floor area to determine the number of bd. ft. of stock necessary.

1. How many bd. ft. of 1" x 8" P.&M.N.C. roofers are required for the rough flooring of the first floor in this house? See plan, Figure 3, Sheet 5; and Figure 5, this sheet.
2. At \$47.00 per M, what will the sub-flooring cost, Problem 1?
3. What will the labor charge be for laying this rough floor at \$2.00 per hundred board feet?
4. Oak finish flooring "Select" grade 2 1/4" face is to be laid throughout the 1st floor at \$97.50 per M bd. ft. See explanation Figure 5. How much will the stock for this finish floor cost?
5. Find the labor charge for laying this finish flooring at \$3.00 per square (100 sq. ft. surface measure).
6. At 2 1/2¢ per sq. ft., what will it cost to sand and scrape this floor?
7. Assuming that this house is 18'-0" high from the under side of the sill to the top of the double 2" x 4" plate, how long should the studs be cut? See Figure 6.
8. Allowing for three 2" x 4"s at each corner, how many studs will be required to frame the exterior walls? (unless otherwise specified studs are spaced 16" O.C.)
9. How many bd. ft. of studding will be needed?
10. How many bd. ft. of material are in the plates?
11. What will the studding and plates cost at \$44.50 per M bd. ft.?
12. If the plans call for a foundation wall height of 7'-6", how much will ready-mixed concrete cost for the foundation, Fig. 3, Page 5, at \$6.30 per cubic yard?

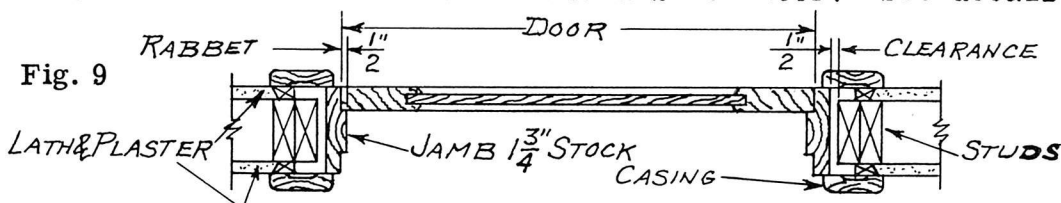
C. MISCELLANEOUS



C. MISCELLANEOUS

REFER TO THE DRAWINGS ON THE PRECEDING SHEET AND SOLVE THE FOLLOWING PROBLEMS.

1. What is the length of the house measured along the west (rear) wall?
2. Find the overall width at the north end.
3. How wide is the Ell measured along its south wall?
4. Give the length of the main house measured along the east wall.
5. What is the width of opening between studs for triple windows in the north wall? See detail Sheet 7.
6. What is the distance from the northeast corner of the building to the center of the front (east) door?
7. Find the width of the rough opening that should be cut for the triple windows in the west wall of this building.
8. Allowing a 6" bearing on the girder, what length joists should be ordered for the north span?
9. What length of joist should be cut for the center span allowing the same bearing on girders?
10. How many joists will be required for the south span?
11. Find the number of board feet of joists required for the entire first floor.
12. At \$48.60 per M board feet, what will these joists cost?
13. What will the net cost of the joists be if a discount of 8% is given and an additional discount of 2% is allowed for payment in ten days?
14. How wide should the opening between studs be for the single windows shown on this floor plan, allowing 2 1/2" outside of the jamb for the weight pockets?
15. Allowing 1/2" at each jamb for clearance, what width opening should be left between studs for a 2'-8" door? See detail below.



C. MISCELLANEOUS

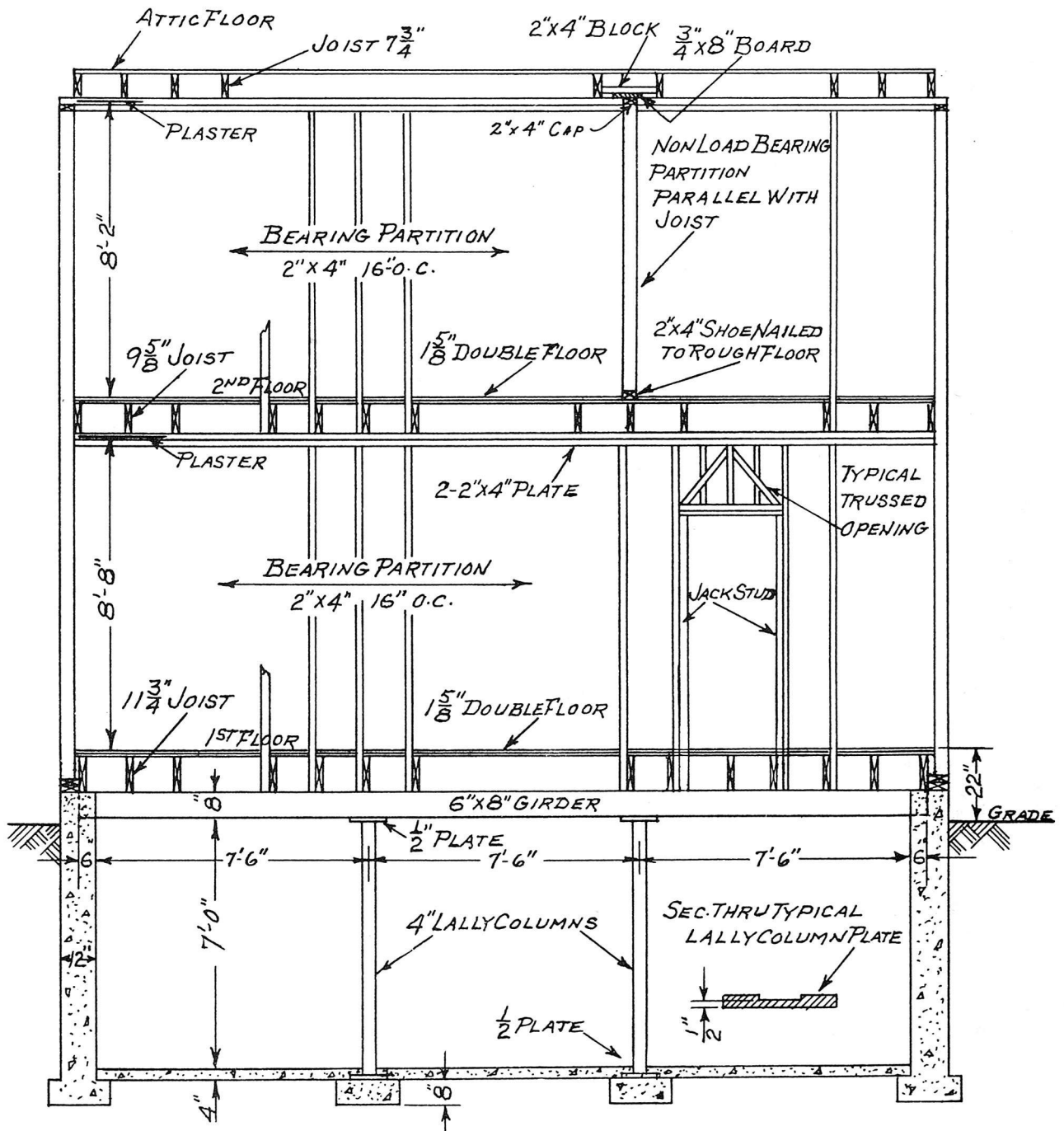


Fig. 13

C. MISCELLANEOUS

NOTE:- Bearing partition studs extend from top of girder to under side of the double plate under second floor and, usually, from the top of plate to under side of plate under attic floor. The thickness of a double 2" x 4" plate will usually be about 3 1/2".

Studs are ordinarily placed 16" on centers.
Rough openings for doors should be about 3" wider than door to allow for jambs and clearance on either side.

CONSULT THE FRAMING SECTION ON THE PRECEDING SHEET AND SOLVE THE FOLLOWING PROBLEMS.

1. How long should bearing partition studding be between 1st and 2nd floors?
2. What length of studding is required for bearing partition studding, 2nd floor to attic floor?
3. How long should the "lally" columns be?
4. If this building is 31'-0" wide, how many studs are required for the bearing partition in first story if there are two 2'-8" x 6'-8" doors and one plastered arched opening 5'-6" wide and 6'-8" high?
5. How long should jack studs be for 6'-8" doors in first story allowing 2" clearance for head jamb?
6. What is the length of jack studs in 2nd story for 6'-8" doors?
7. How long must double headers over 2'-8" door be?
8. The cost of studding for first story bearing partitions will be how much at \$46.60 per M.?
9. Second floor bearing partition studding will cost how much?
10. Non-load bearing partitions shown in second story require studding of what length?
11. What length are studs for first story non-bearing partitions?
12. What is the depth of excavation below average ground level?
13. How long is girder?
14. How many board feet of material are there in the girder?
15. Determine the cost of the girder at \$50.00 per M.

C. MISCELLANEOUS

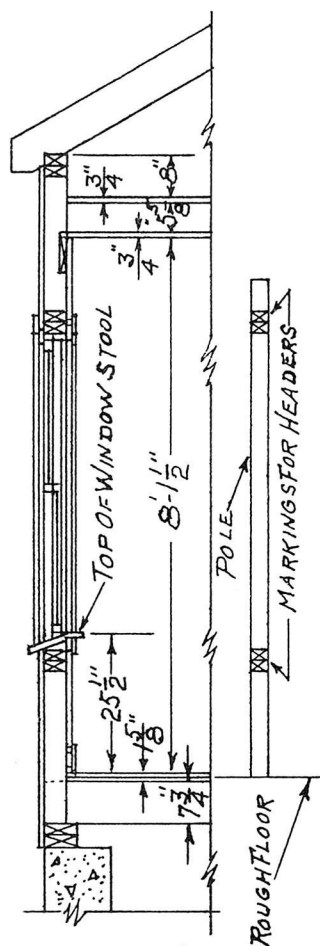
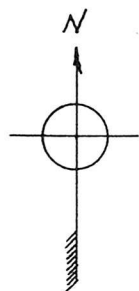


Fig. 10

SECTION A-A

NOTE - Wall section of garage
same as above as regards
height and window location.



NOTE:

All Windows
to be
2'-4'' x 4'-6''

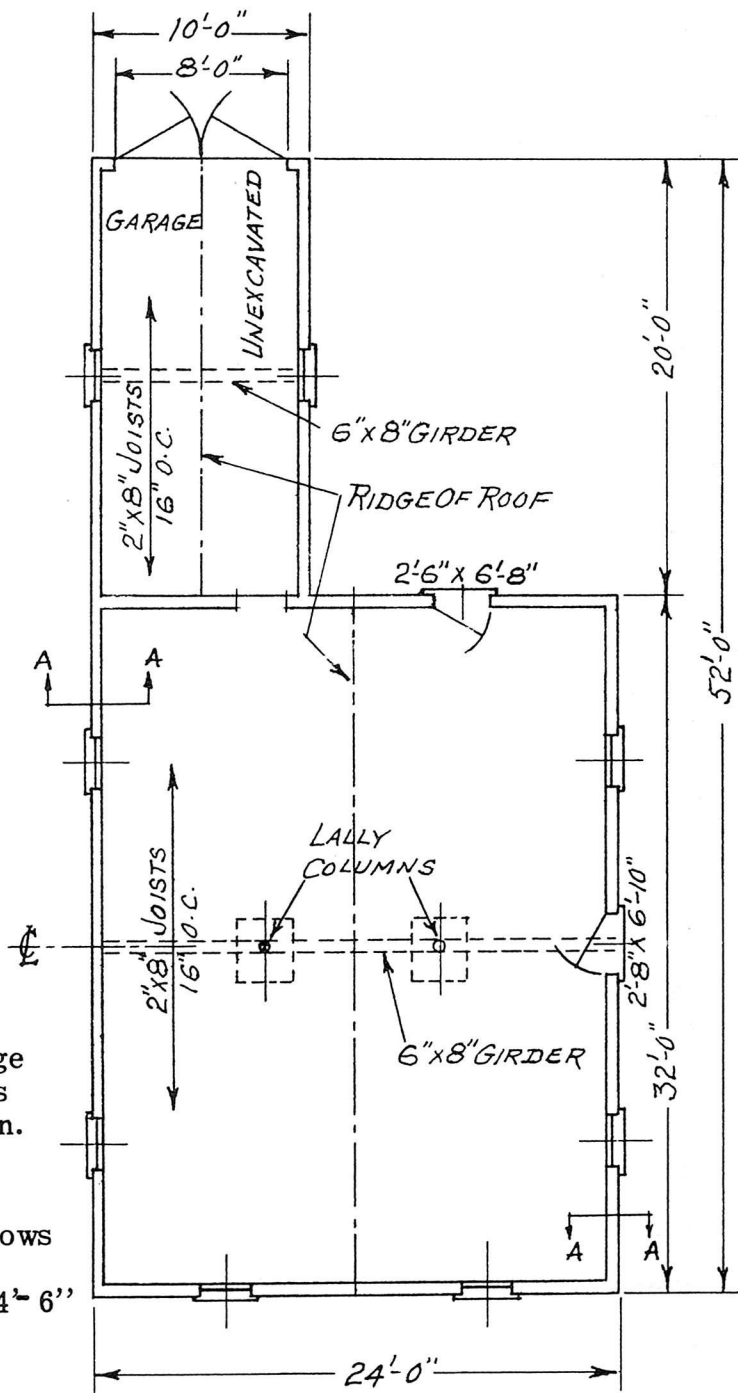


Fig. 11

C. MISCELLANEOUS

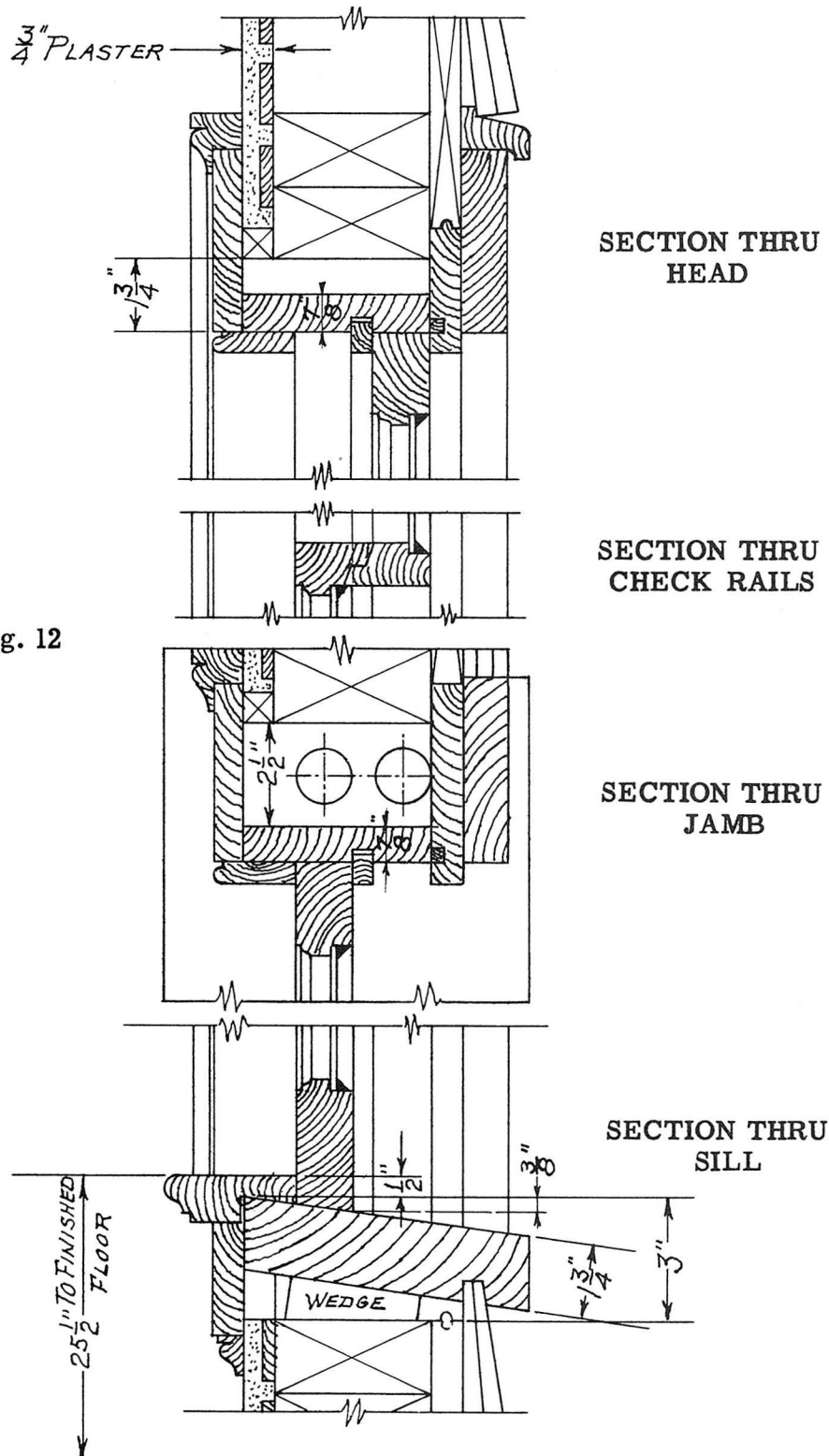


Fig. 12

C. MISCELLANEOUS

REFER TO DRAWINGS SHEETS 11-12 AND SOLVE THE FOLLOWING PROBLEMS

1. Find the length of the exterior wall studding.
2. What width of rough opening should be cut for the windows if there are to be 2 1/2" weight pockets in all window frames?
3. Find the lengths of the floor joists.
4. Give the distance from top of sill to top of ribbon board.
5. Find how many floor joists are needed spaced 16" on centers.
6. Find the cost of the floor joists at \$44.60 per M.
7. Give bd.' ft. of 1" x 8" P & M N.C. roofers needed for rough floor.
8. Consult detail of double hung window and determine the distance from rough floor to top of bottom window header.
9. Find the distance from bottom of upper header to the rough floor.
10. A pole with end resting on the rough floor is used to mark proper place to cut studs for the height of window opening. What will the distance from the rough floor be to cut off mark for bottom header and from floor to cut off mark for top header?
11. Find the number of board feet of finish flooring needed on this project. Flooring to be $\frac{3}{4}$ " x 2 $\frac{1}{4}$ ", matched and end matched.
12. At \$98.60 per M, what will this flooring cost?
13. If a bundle of lath will cover 6 1/2 sq. yds., how many bundles are needed for ceilings?
14. How many bundles are required for side-walls after deducting door and window openings?
15. Find cost of lath for the building @ 97 1/2¢ a bundle.
16. At 45¢ a sq. yd., what will it cost to plaster side-walls and ceiling with brown and hard finish? Deduct areas of all openings.
17. Find the number of sq. ft. needed to line the garage (walls and ceiling) with 1/2" insulating board such as "Celotex" or "Nuwood".
18. At \$58.00 per M sq. ft., what will this insulating board cost?
19. Find the lengths of girders allowing 6" bearing on each end.
20. Find board feet contents of girder.

C. MISCELLANEOUS

REFER TO DRAWINGS SHEETS 11-12 AND SOLVE THE FOLLOWING PROBLEMS.

1. How many 2" x 4" studs are needed for the exterior walls of the main house if they are to be set 16" O.C.?
2. Find the number of studs needed for the garage set 2'-0" O.C. allowing for double studs each side of the door opening and at the two outside corners.
3. Give the lineal feet of plates needed (doubled) for main house.
4. Find the number of bd. ft. of 2" x 4" stock required for exterior studding and plates for the main house.
5. What will this stock cost @ \$42.20 per M board feet?
6. How many board feet of 1" x 8" T & G N.C. roofers are needed to sheath the south wall of this building to the plate?
7. Find the amount of 1" x 8" T & G N.C. roofers required to sheath the west wall of the main house.
8. Is it necessary to figure the sheathing for the east wall?
9. Estimate the rough boarding for the garage.
10. How many rolls of building paper are needed for this job if each roll contains 500 sq. ft. of paper? How many 200 sq. ft. rolls will be required? Include house and garage.
11. What will the sheathing for the entire job cost @ \$38.40 per M board feet?
12. Find the cost of "BERMACO" building paper for this job @ \$0.90 per roll (500 sq. ft.)
13. What would be the cost of a better grade of paper if its price per roll is the same as in Problem 12 but contains only 200 sq. ft.?

NOTE:- Clapboards 6" in width, spaced 4" to the weather, cover $\frac{2}{3}$ of their width. Therefore $33 \frac{1}{3}\%$ must be added to area to be covered when figuring clapboards, and some allowance also must be added for waste depending on the number and type of openings also number of outside and inside corners. This is a matter of good judgment and 5% will be the waste allowance in the following problems.

14. Deducting openings, how many sq. ft. of clapboards are needed for the south end of the main building?
15. Find the sq. ft. of clapboards needed for the entire job.

C. MISCELLANEOUS

16. At \$71.20 per M, what will the clapboards cost?
17. If 10" clapboards were laid 8" to weather, how much allowance must be made for loss of coverage?
18. Using 10" clapboards, how many square feet are needed?
19. At \$77.84 per M for 10" clapboards, what is the cost?
20. If a 2'-4" x 4'-6" window frame with sash-cord and weight costs \$5.625, what will windows for this job cost, with a 10% contractor's discount and a 2% discount for payment in ten days?
21. Using a 5" baseboard and a 1" water table (base flush with bottom of sill), how many inches t.w. must clapboards be spaced to reach under side of window stool (spacing to be as near 4" as possible)?
22. If window frames have 4 1/2" head casing with 3/4" drip cap and 1 3/4" stool, what is clapboard spacing from bottom of stool to top of cap (approximate spacing 4")?
23. If center of window frame is 6'-2 3/4" from corner of building with 4 1/2" casing (construction as shown on detail), how long will clapboards be from corner to window casing. Allow 1/2" for mitering at corner.

C. MISCELLANEOUS

REFER TO DRAWINGS SHEETS 11-12 AND SOLVE THE FOLLOWING PROBLEMS.

1. What length of rafter is required for the main roof if its pitch is 8" to each foot? Allow for 12" rafter overhang.
2. If the garage roof has the same pitch and cornice overhang as the main roof (Problem 1) determine the length of the rafters.
3. How many feet, board measure, of $3/4$ " x 4" square edged roof boards are needed on the main roof, if they are spaced 2" apart?
4. Using wood shingles laid 5" to weather, how many M (thousand) are needed on main roof?

Note:- A standard shingle is considered to be 4" wide. Determine the area of the roof in square inches and divide by the area in sq. in. covered by one shingle (distance to weather x 4"). For this type of roof (simple areas) add 5% for waste.

5. How many courses of shingles will be needed on each side of main roof?
6. How many shingles will be needed on the garage?
7. At \$3.50 per M, what will be the cost of laying the shingles for the entire roof?
8. Shingles are now often sold by the square (100 sq. ft.). How many squares are needed for the entire building?
9. If the shingles cost \$7.50 per M, what is the cost per square?
10. At \$3.50 per M for laying shingles, what does it cost per square?
11. How many lineal feet of 2" x 4" shingling staging are needed if a staging is placed every 10 courses?
12. If a tradesman lays 2156 shingles in a day at \$3.50 per M, what does he earn?
13. If the shingles were laid 5 1/2" to the weather, how many M would be needed for this job?
14. If this roof, including garage, were boarded tight with $3/4$ " x 8" T & G roofers, how many board feet would be needed?
15. At \$36.00 per M, what will $3/4$ " x 8" T & G roofers cost for this job? At \$33.60 per M, what would $3/4$ " x 4" roofers cost as in Problem 3?
16. Costing \$2.10 per square, what is the cost of laying roofers specified in Problem 15, first question?

C. MISCELLANEOUS

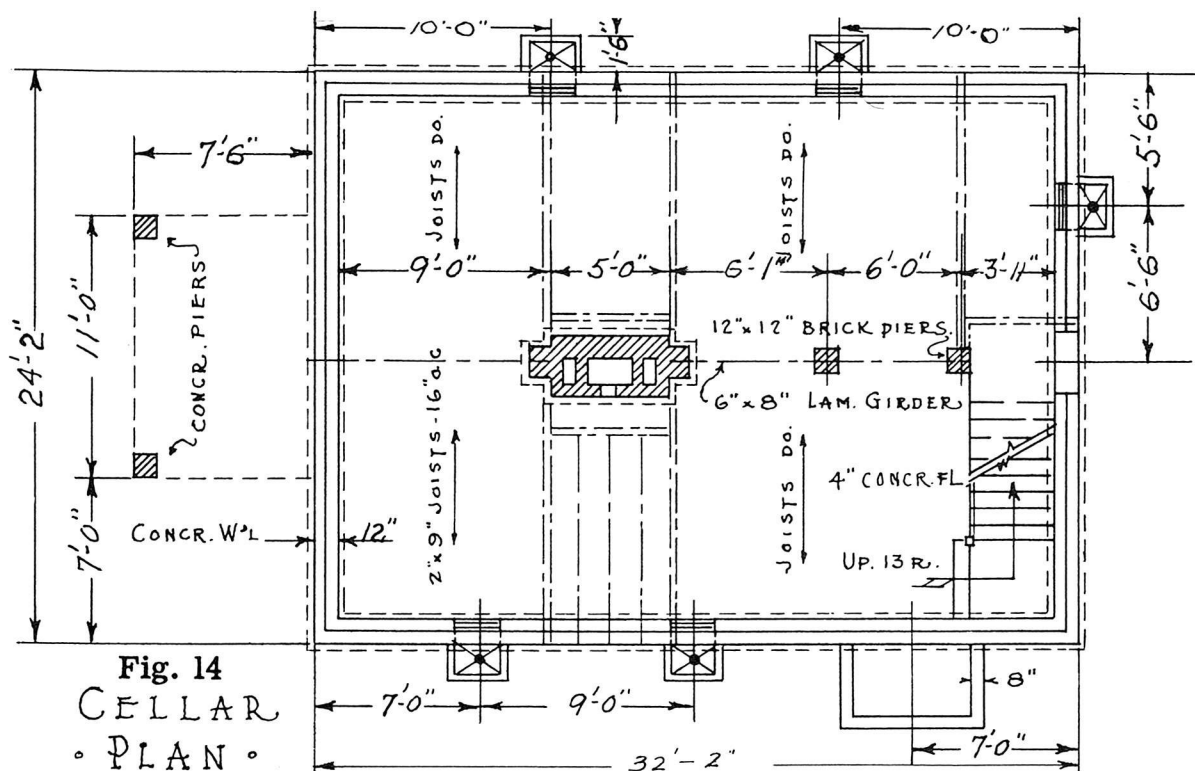


Fig. 14
CELLAR
• PLAN •

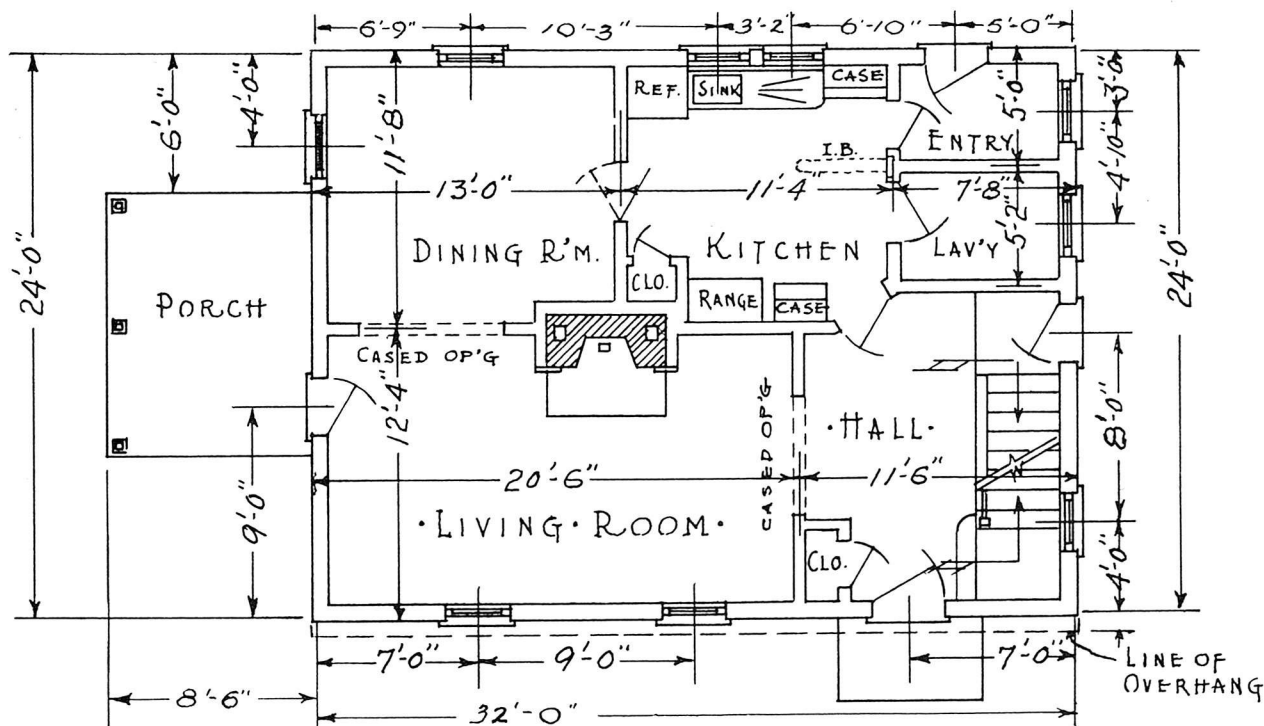
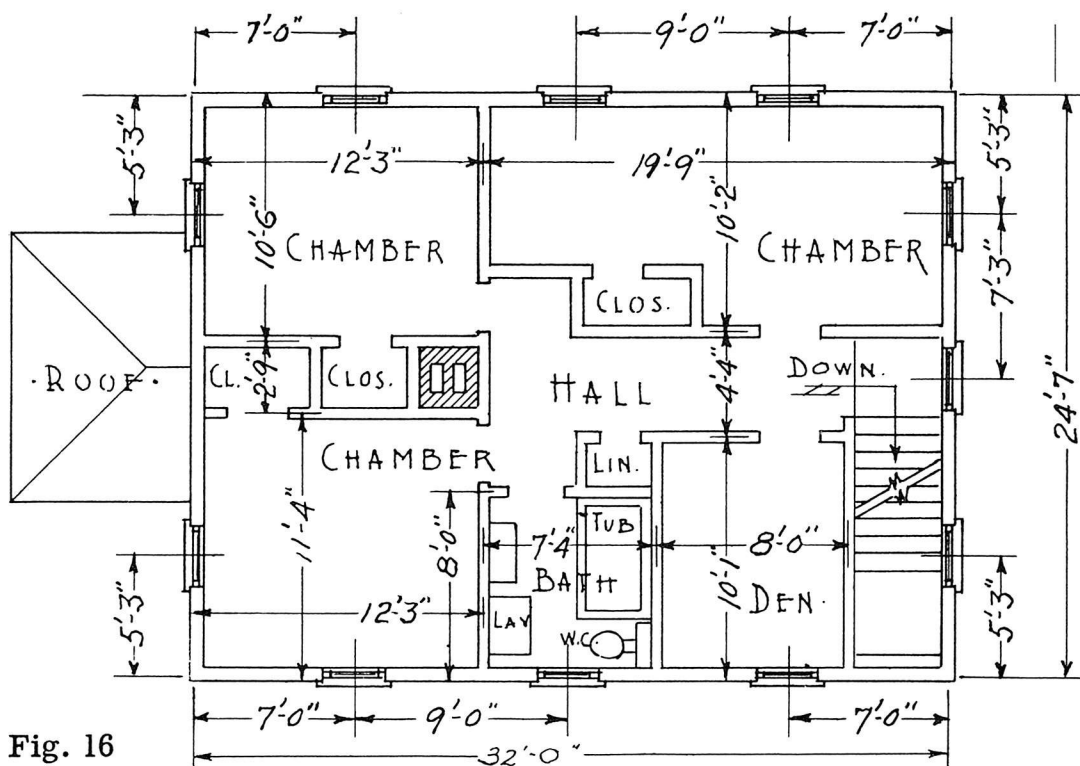
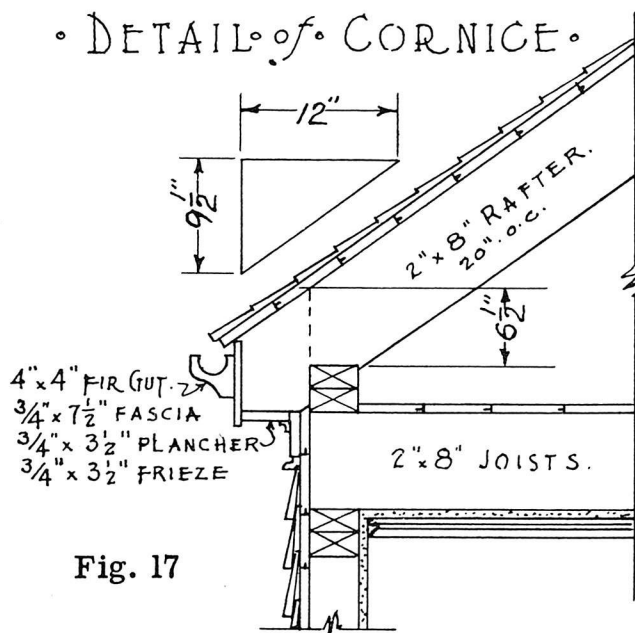


Fig. 15
• FIRST FLOOR PLAN •
SCALE - $\frac{1}{8}'' = 1' - 0''$

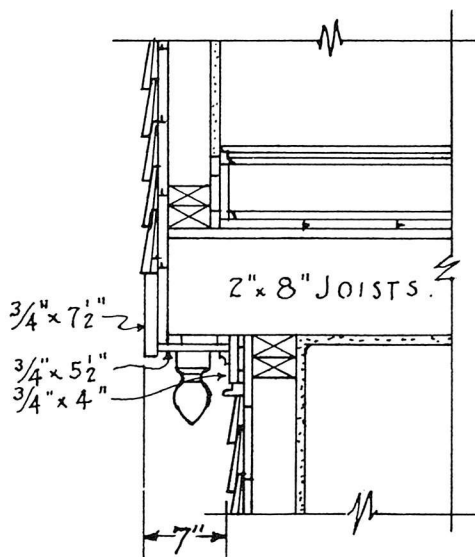
C. MISCELLANEOUS



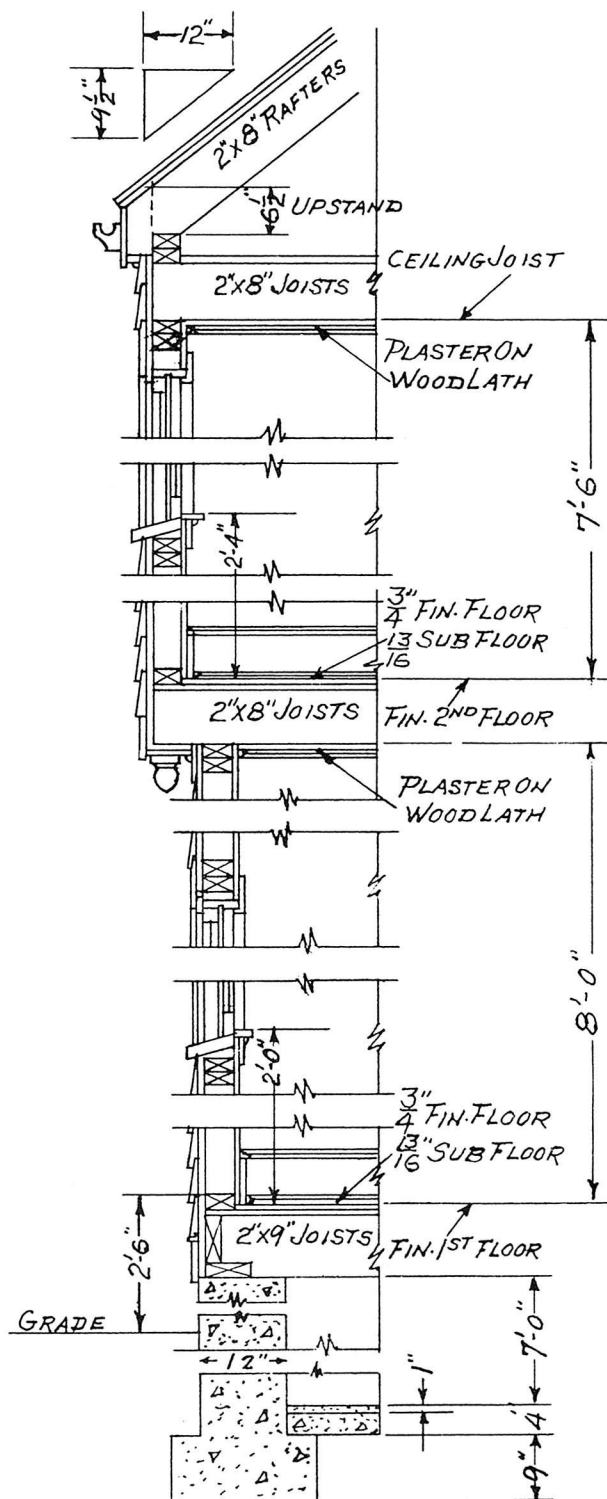
• DETAIL of CORNICE •



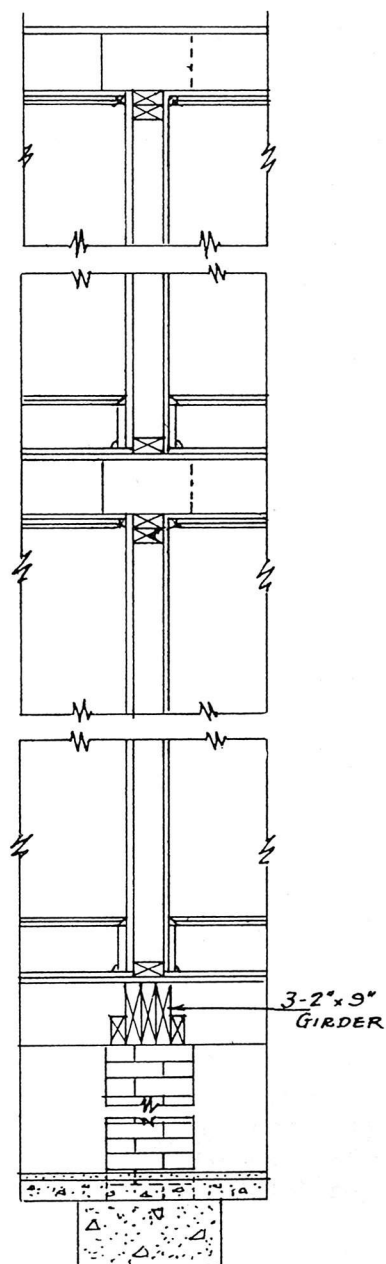
• DETAIL of OVERHANG •



C. MISCELLANEOUS



EXTERIOR WALL SECTION
Fig. 19



BEARING PARTITION SECTION
Fig. 20

C. MISCELLANEOUS

REFER TO THE DRAWINGS SHEETS 17-18-19 AND SOLVE THE FOLLOWING PROBLEMS.

1. Determine how many lineal feet of baseboard are needed, 1st and 2nd floors, deducting openings. (No base in Lavatory).
2. What lengths will be most economical to buy?
3. What lengths should the first floor joists be, and how many of each length are needed?
4. Find how many bd. ft. of 1" x 6" T & G N.C. pine roofers are needed for the rough first floor.
5. How many square feet of flooring are needed to floor the porch?
6. How many bundles of wood lath are needed for the entire building, walls and ceilings, if one bundle covers 6 square yards?
7. Consult the staff section and determine how many steps are needed for stairs to second floor, keeping rise of each step as near 7 1/2" as possible. How many treads will there be?
8. How many square feet of floor tile are needed in the lavatory?
9. If walls in the lavatory are tiled 4'-0" high, how many square feet of tile will be laid?
10. If the kitchen sink must be 42" high from finished floor to top of back, how far above the rough floor must the window frame be set?
11. How much shorter must the kitchen window be than the other windows and what height frame would you order if the other windows are 4'-10" high?
12. How many bd. ft. of finish wood flooring, having 2 1/4", face are required for first floor (tile in lavatory)?
13. At \$110.00 per M, what will finish wood floor cost (1st floor)?
14. What will be the cost of the rough floor at \$45.30 per M (1st floor)? Refer to Problem 4.
15. How much will the sheathing cost at \$45.30 per M (consult staff section and figure sheathing for the whole house)?
16. If all inside doors are 2'-8" x 6'-8", how many lineal feet of casing are needed?
17. What lengths of trim stock would you order for door casings?
18. If you buy bundled trim for all windows at an average price of \$2.32 per window, what will it cost?

C. MISCELLANEOUS

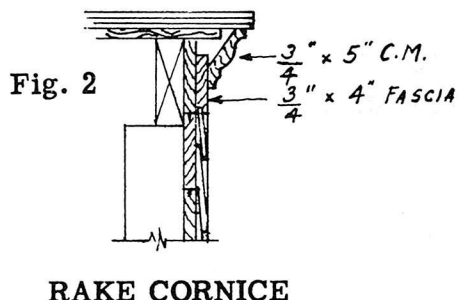
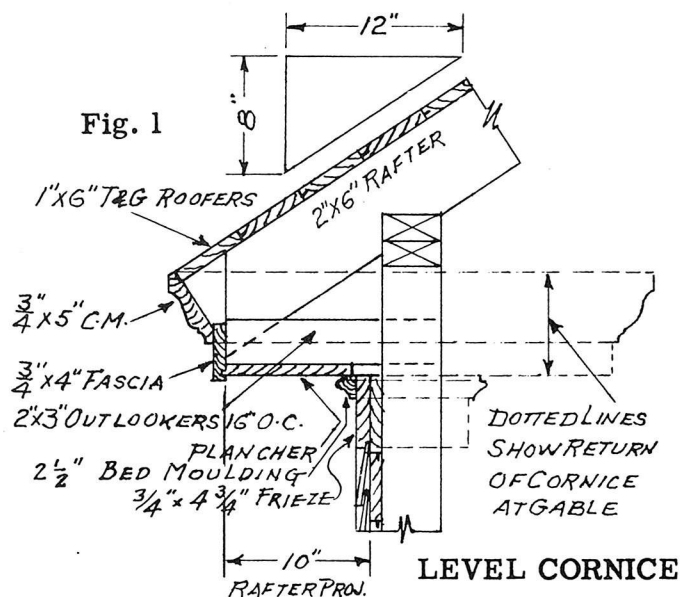
REFER TO DRAWINGS SHEETS 17-19 AND SOLVE THE FOLLOWING PROBLEMS.

1. If the chimney goes through roof at the center of ridge and projects above ridge 2'-6", how high will it be, measured from the footing at the under side of basement floor?
2. Find the length of studding for the first story walls.
3. What is the length of the second story studding?
4. How many lineal feet of 2" x 4" plate stock are needed for the first story?
5. How many lineal feet of 2" x 4" stock are required for the second story plate?
6. What is the distance from top of first floor joists to under side of second floor joists?
7. What should be the dimension from top of second floor joists to under side of attic joists?
8. What is the distance from the under side of the rough first floor to the soil grade for the cellar floor slab?
9. From the under side of the first floor joists to the under side of the pier footings is what distance?
10. Find the length of the bearing partition studs (1st story).
11. Bearing partition studs, second floor to attic, must be how long?
12. At \$44.65 per M, what will plates cost?
13. How many studs are needed for 1st floor if walls are framed solid, the openings being cut out afterwards?
14. What will they cost at \$44.64 per M.?
15. What number of studs are required for second floor walls? Figure same as in Problem 13.
16. If the top of the window stool is 24" from finish floor, what is length of stud beneath window on 1st floor?
17. What length of stud is needed above window, if window (sash opening) is 4'-10" high?
18. Basement sash are 2'-6" high and their frames have head jambs 1 1/4" thick and 1 3/4" sills. How deep will the excavation for window areas need to be, if 6" is allowed from under side of sills to top of area floor which is 4" thick. Frame is to set tight against under side of main sill.

C. MISCELLANEOUS

19. What is the distance from the basement floor level to the under side of basement sash? See figures, Problem 18.
20. How many lineal feet of 2" x 9" are needed for girders?
21. What lengths would you order for girders? (6" bearing on walls).
22. What is the width of riser stock for the basement stairs, if the treads are $1 \frac{1}{8}$ " thick?
23. If you use 10" treads, $\frac{7}{8}$ " of which is nosing overhang, what length must rough opening in floor be to give 6'-0" head room under header over basement stairs?
24. Find length of rough stringer for stairs.
25. How much $\frac{3}{4}$ " trim stock is required to trim the second floor overhang?
26. How many lineal feet of 4" x 5" fir gutter will be required for the main cornice? There will be no return at gables.
27. At \$74.50 per M, how much will the frieze, fascia, and plancher cost for the main level cornice?

D. CORNICES



REFER TO THE CORNICE DETAILS SHOWN AND TO THE PLANS ON SHEET 7 AND SOLVE THE FOLLOWING PROBLEMS.

1. How many outlookers (see Figure 1) would you get out for the level cornice of the main building?
2. What width material would you order for the plancher?
3. List the frieze, plancher and fascia for the level cornice of the main building.
4. At \$72.485 per M, how much will the material in Problem 3 cost?
5. List the crown and bed mouldings for the level cornice.
6. At \$.05 per lineal foot for the crown moulding and \$.03 per lineal foot for the bed moulding, how much will these members cost for the level cornice?
7. List the material for the Rake cornice, Figure 2, of the main building.
8. Using the same cornice details, list the materials for the level cornice of the one story wing.
9. Using the same cornice detail, list the materials for the rake cornice of the wing.
10. At the price listed in Problems 4 and 6, how much will all of the cornice stock cost for the one story wing?

D. CORNICES

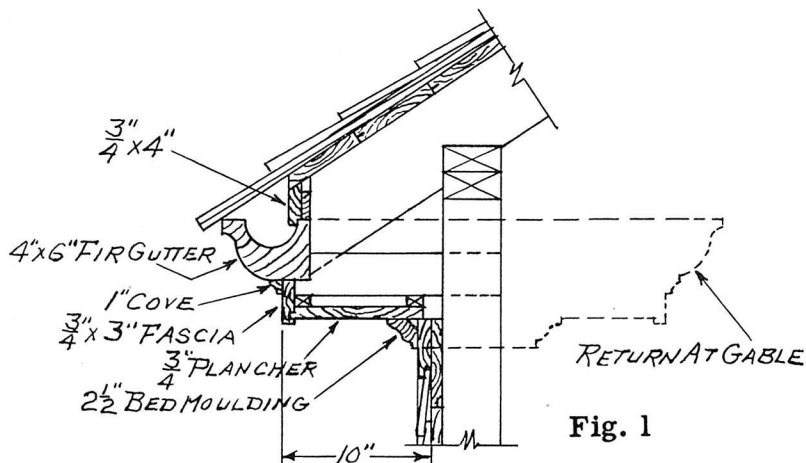


Fig. 1

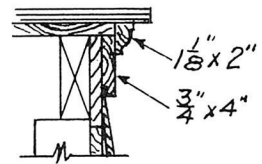


Fig. 2

REFER TO THE CORNICE DETAILS ON THIS SHEET AND TO THE FLOOR PLANS ON SHEET 17, AND SOLVE THE FOLLOWING PROBLEMS.

- Figure 1 is a section through the main level cornice. How much fir gutter should be ordered for both sides of building and returns?
- How many board feet of material are required for fascia and plancher?
- At \$.03 per lineal foot for the fascia and \$.08 for the plancher, what will these members cost for the main level cornices? At \$.08 per lineal ft. for the plancher, what would that amount to per board foot?
- List the materials for the rake cornices, Fig. 2, both gables.
- How much 1" cove and 2 1/2" bed moulding is required?
- How much crown moulding will be required for the porch cornice (Fig. 3)? How much bed moulding?
- How many board feet of 1" x 6" sheathing will be required for the porch ceiling?
- List the material for the inside and outside frieze and soffit members for the porch.
- At \$74.65 per m, how much will the plancher and fascia cost for the porch cornice?
- List the ceiling moulding and determine the cost of all cornice and porch mouldings @ \$.01 per lineal foot, per inch of width.

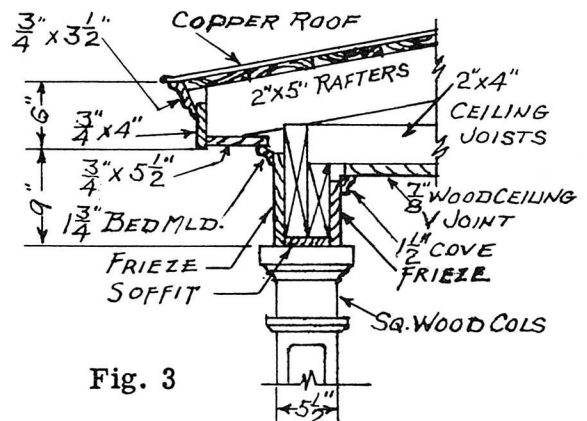
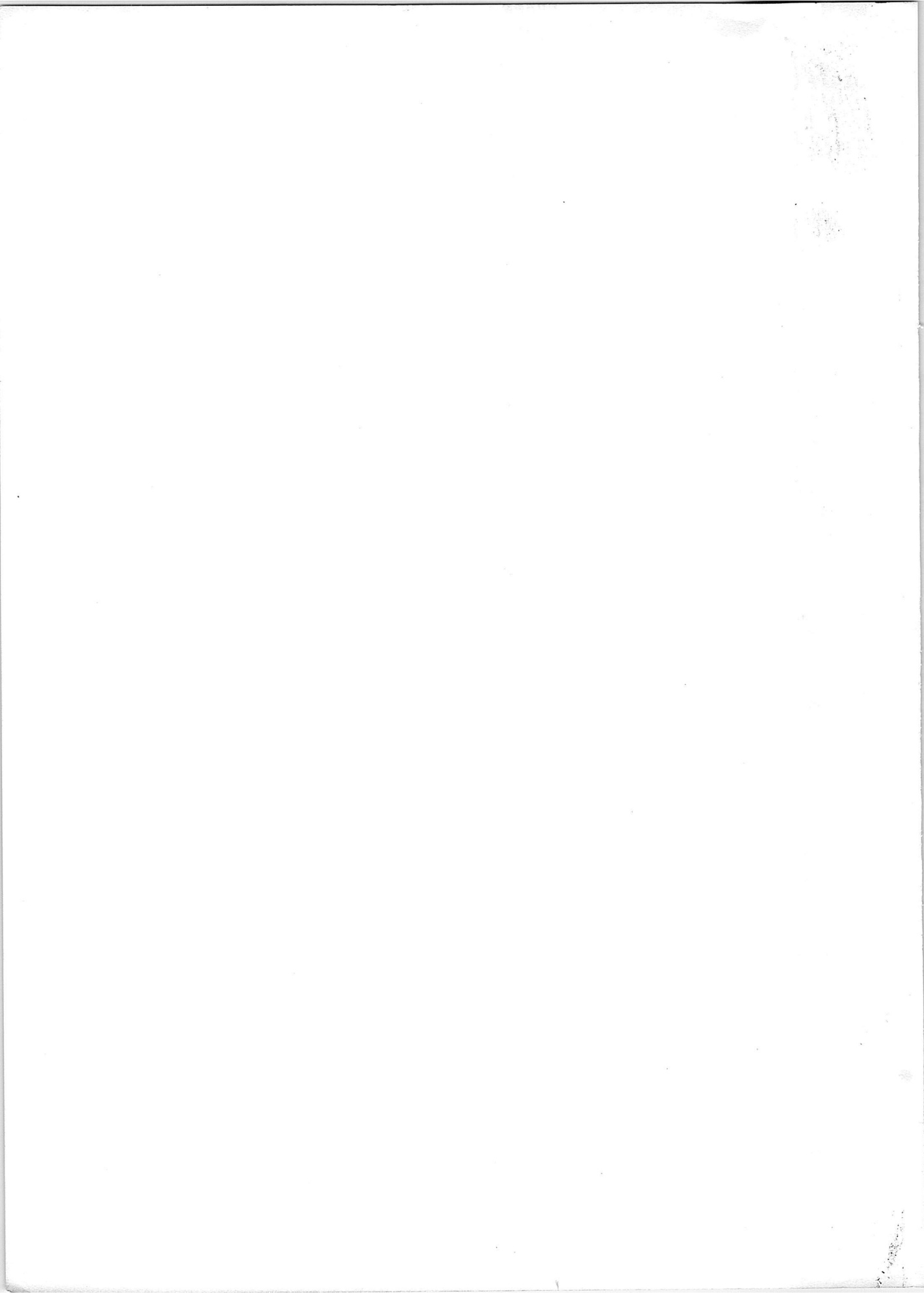


Fig. 3



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